Volume 1

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Statewide water management systems include physical facilities and statewide water management systems. Facilities are the backbone of water management in California. Water management systems, like water quality standards, monitoring programs, and statewide water efficiency programs help meet major State government responsibilities for statewide water planning and ecosystem restoration. (DWR photo)

Chapter 3 California Water Today

About This Chapter

Chapter 3 California Water Today describes our natural resources and their influence in building the nation's largest economy and attracting a growing population. The chapter reports statewide and regional water challenges and how we are meeting those challenges with a variety of responses, including task forces and advisory committees, partnerships and integrated regional water management, programs, water bonds, water management systems, research and reports, legislation and regulation. Finally, the chapter recounts the many facets of California's water rights, usage, and allocation.

Setting

California boasts some of the world's most beautiful land and richest soil, which support an economy that is the largest and most diverse in the nation. Planning and management of California's water resources require full and balanced consideration of its people, environments, businesses, land uses, climates, geology, and variable hydrology.

Climates, Ecosystems, Physical Settings

California is a state of contrasts and diversity. The highest (Mount Whitney) and lowest (Death Valley) points in the contiguous United States are not far from each other. The range of annual rainfall varies greatly from more than 140 inches in the northwestern part of the state to less than 4 inches in the southeastern part (DWR 2003 Bulletin 118). Being about a thousand miles from its northwest to southeast corners, California is the third largest state in the nation. Its geomorphic features include the Klamath Mountains, Modoc Plateau, Cascade Range, Central Valley, Sierra Nevada, Coast Range, Great Basin, Transverse Ranges, Mojave Desert, Peninsular Ranges, and Colorado River Desert (Figure 3-1 Map of California's major geomorphic features).

Precipitation varies widely in California—from place to place, from season to season, and from year to year. Climate is dominated by the Pacific storm track. Most precipitation and runoff occur in the northern part of the state. The numerous mountain ranges cause orographic lifting of clouds, producing precipitation mostly on the western slopes and leaving a rain shadow on most eastern slopes. Snowmelt and rain falling in the mountains flow into creeks, streams, and rivers. As flows make their way into the valleys, much of the water percolates into the ground.

Groundwater and surface water are inextricably linked in the hydrologic cycle. The vast majority of California's groundwater that is accessible in significant amounts is stored in alluvial groundwater basins, which cover nearly 40 percent of the geographic area of the state (DWR 2003 Bulletin 118). Groundwater supplies contribute water used for beneficial purposes. Interbasin storage and transfer projects allow for redistribution of water to where it is needed for crops, people, and industry (Figure 3-2 Map of California with major rivers and facilities).

The state's ecosystems, from mountain watersheds to coastal beaches to inland deserts have been called California's natural infrastructure, supporting its population and economic growth. These varied environments also support an estimated 5,000 native flora species—more than one-third are unique

Figure 3-1 Map of California's major geomorphic features

Being about 1,000 miles from its northwest to southeast corners, California is the third largest state. Its geomorphic features include the Klamath Mountains, Modoc Plateau, Cascade Range, Central Valley, Sierra Nevada, Coast Range, Great Basin, Transverse Ranges, Mojave Desert, Peninsular Ranges, and Colorado River Desert.

Figure 3-2 Map of California with major rivers and facilities

Snowmelt and rain flow into creeks, streams and rivers, and much of the water percolates into the ground as it makes its way into the valley. Interbasin storage and transfer projects allow redistribution of water to where it is needed for crops, people, and industry.

to California—and 1,000 introduced species (CERES 2003). Diverse landforms have preserved unusual species like giant redwoods and made homes for hundreds of species of birds, mammals, and reptiles.

Since the 1800s, California's natural infrastructure has experienced aquatic and riparian habitat degradation and declines in freshwater biodiversity. Hydraulic mining and gold extraction in the 1800s, dam construction and operation, pollution, flood control, urbanization, increases in Sacramento-San Joaquin Delta exports and upstream diversions, and introduction of non-native species have all contributed to a decline in the state's watersheds, wetlands, and the health of our ecosystems. Flows on many rivers and streams currently do not resemble natural hydrographs. This is a contributing factor to impaired ecosystem functions, reduction and destruction of native species and habitats, impacts on commercial fisheries, and degraded water quality.

Industry, People, Social Setting

California has the largest and most diverse economy in the nation with a gross product of more than a trillion dollars, 13.5 percent of the U.S. total (DOF 2003). The economy is a mix of long-established industries such as agriculture and mineral extraction and emerging industries such as biotechnology, telecommunications, and computer technology. California has the largest manufacturing complex in the nation. Its natural beauty has helped make California the No. 1 travel destination in the United States. In addition to world-renowned beaches and rivers, we have wetlands and wildlife refuges for bird watching and hunting, activities that contribute hundreds of millions of dollars annually to the state's economy (See Figure 3-3 Gross state product, 1980-2001).

The state's multibillion dollar agribusiness makes California the nation's leading agricultural producer. California contributes more than half of the nation's fruit, nut, and vegetable production. Many counties rely on agriculture as a primary economic contributor. Providing food and fiber crop products to Californians, as well as to other states and countries, consumes more water than is consumed by all municipal and industrial uses. And it will continue to do so.

The location and timing of our variable water uses do not coincide with the state's natural water supplies. The Gold Rush spawned a technology of water movement that helped cultivate California's agricultural landscape and was used in the early 1900s to urbanize the San Francisco area and the Los Angeles Basin (Starr 2000). With the population boom after World War II, the state's urban centers spread, and a suburban, automobile-dependent style of community development became the hallmark of California. (See Box 3-1 Historical Perspective of Water Development in California.)

California's population increased from about 30 million in 1990 to about 36.5 million in 2004. The nation's most populous state is now growing by about 600,000 people per year. The California Department of Finance (DOF) projects that the population may exceed 48 million by 2030—an additional 12 million people[1]. By 2050 California's population may jump by more than 20 million people to reach a total of nearly 55 million, according to long-range population projections issued by DOF in May 2004. Figure 3-4 depicts the state's total population and growth from year 1960 through year 2000, plus DOF's most recent projections to year 2030.

The DOF projections indicate the majority of Californians will continue to reside in Southern California, and Los Angeles will remain the most populous county in California, exceeding 11 million people in 2050. Riverside is projected to overtake Orange County and become the third most populous county behind San Diego.

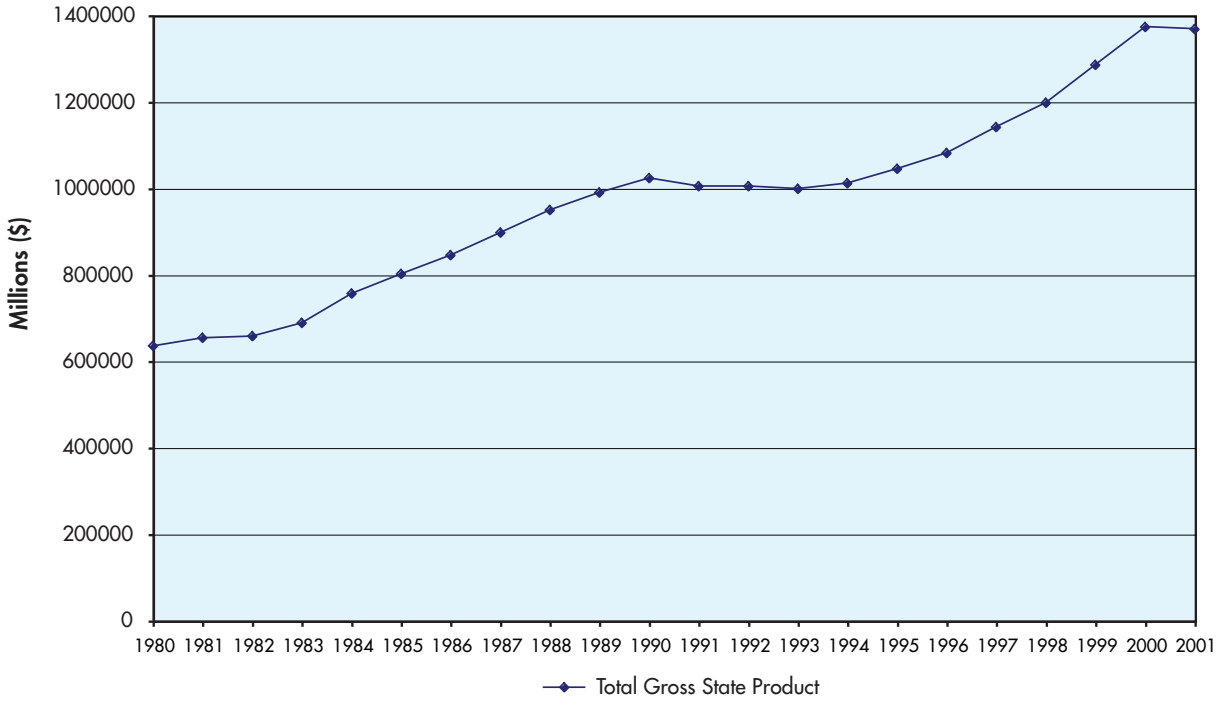
In California's Central Valley, San Joaquin County is expected to triple in size and experience the greatest percentage increase over the 50-year period—200 percent. Other counties with large projected percentage increases include Merced, Placer, and Madera (DOF 2004).

Water Uses, Supplies, and Quality

From a statewide perspective, California meets most of its agricultural, municipal, and industrial water management objectives in most years. Most of our demands are being met with the help of advances in water conservation and recycling, combined with infrastructure improvements including new storage and conveyance facilities. Except in multiyear droughts, most urban areas have sufficient supplies for existing populations. Cities use about the same amount of applied water today as they did in the mid-1990s, but accommodate 3.5 million more people. Water conservation and demand reduction strategies are expected to continue playing a prominent role in achieving future goals.

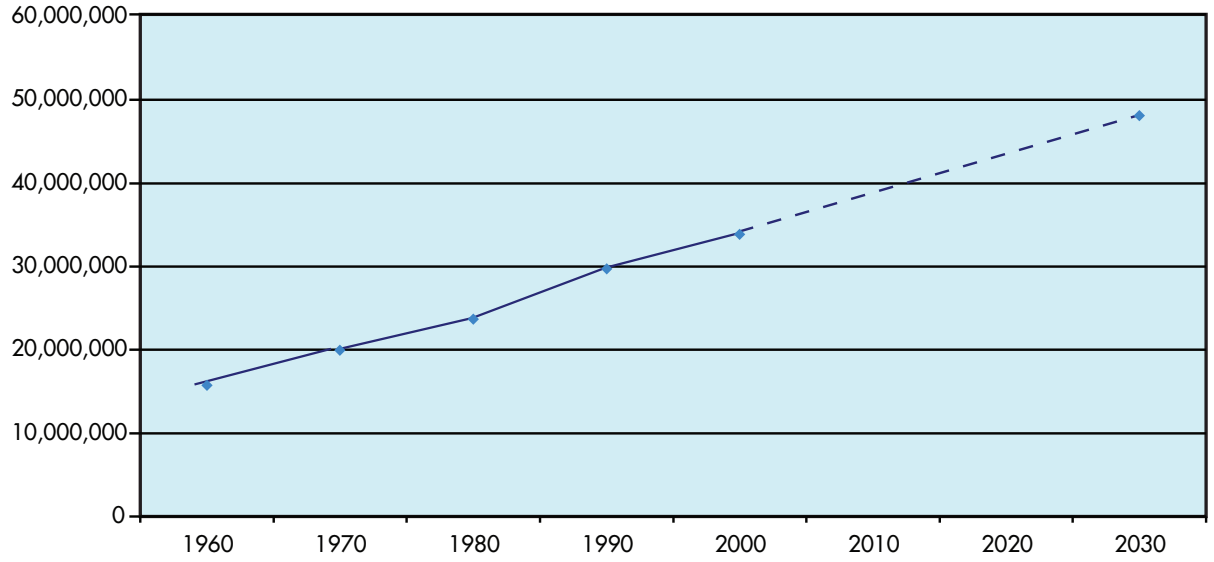
[1] The estimates of changes in future water demands presented in this water plan update are based on assumptions about future population growth for the period 2000 to 2030. For the Current Trends and Less Resource Intensive scenarios this corresponds to the Department of Finance estimates with a population increase of 14 million, from about 34 million in 2000 to 48.1 million in 2030. For the More Resource Intensive scenario this corresponds to a population increase of 18 million to a total population of 52.3 million in 2030.

Figure 3-3 - Gross state product, 1980-2001



California has the largest, most diverse economy in the nation with a gross product of more than a trillion dollars. It is a mix of long-established industries such as agriculture and mineral extraction, emerging industries such as biotechnology, telecommunications, and computer technology, entertainment and tourism.

Figure 3-4 California population, 1960–2030



The nation's most populous state is now growing by about 600,000 people per year. The California Department of Finance projects that the state's population may exceed 48 million by 2030 and 55 million by 2050.

Significant water supply and quality challenges persist on local and regional scales. Water quality is generally good, but many areas face specific water quality problems. Many rural residents on small water systems or wells experience limited water supply as well as water quality impacts during droughts. (See Regional/Local Challenges later in this chapter.) Water supply and water quality are inseparable in water management. Some areas of California rely on over-pumping groundwater basins, which reduces long-term available water supply, increases pumping costs, and in some areas degrades groundwater quality. In many areas surface water and groundwater are impaired by natural and human-made contaminants that can threaten human health, degrade the natural environment, increase water treatment costs, and effectively reduce the available water supply.

Most agricultural water demands are met in average water years. Farmers have learned to grow more crops per acre-foot of applied water by improving productivity and efficiency. For example, from 1980 to 2000 the annual statewide harvest increased by 40 percent measured in tons of crops per acre-foot of applied water. However, in some areas, water sources once used for agriculture are now used for urban needs, environmental restoration, and groundwater replenishment. Even in average water years, some growers forgo planting and other agricultural operations because they lack a firm water supply.

From a statewide perspective, California meets most of its agricultural, municipal, and industrial water management objectives in most years. Most of our demands are being met with the help of advances in water conservation and recycling, combined with infrastructure improvements including new storage and conveyance facilities.

Box 3-1 Historical Perspective of Water Development in California

(From Water Education Foundation. Layperson's Guide to California Water, 2003 Edition)

During the Gold Rush, California miners developed a system of claiming rights to take and transport water. These fortune seekers built the state's first hydraulic works—reservoirs and more than 4,000 miles of ditches and flumes—to sluice out the elusive shining metal. Water was harnessed and blasted into hillsides to dislodge gold in a practice called "hydraulic mining." Debris resulting from these mining practices washed down from the mountains and choked rivers, inundated native salmon spawning grounds, and caused serious problems with flooding for navigation and downstream water users.

As the gold began to diminish, farming grew in the Delta and Central Valley and so did the need for a dependable water supply. While many areas experienced too little water, others had too much. In the maze of swamps, sloughs and marshlands that form the Delta, farmers began building levees around periodically submerged islands and pumped water from behind them to reclaim the land for agriculture. Between 1860 and 1930, most of the Delta's 1,150 square-mile area of freshwater marsh was leveed, drained, and planted.

Elsewhere, groundwater pumping enabled farms and cities to flourish despite the aridity of southern and central California. However, groundwater levels began to drop, which caused an increase in pumping costs. This pointed out the need for a more efficient distribution of the state's surface water supplies.

Groups of farmers banded together, and cooperatives and development companies formed to finance and construct water projects in the San Joaquin Valley and southern California. The inherent problems associated with placing control of such a vital, public resource in private hands brought a move toward increasing public control. The first irrigation district, Turlock Irrigation District, was formed under the Wright Irrigation District Act of 1887. The act evolved into the California Irrigation District Act of 1917 and paved the way for other types of water development and delivery districts, such as county water districts and special services districts. California's two major population centers, the Los Angeles and San Francisco Bay areas, recognized the need to augment local water supplies and were the first to develop faraway sources.

continued

Environmental requirements are not always met, although a considerable amount of water is dedicated to restoring ecosystems. Many flow regimes no longer resemble natural hydrographs, largely because of efforts to manage water storage and diversions to meet competing demands. We do not sufficiently understand ecosystem needs and their response to flow, but significant scientific advancement is taking place. We are seeing improvements when ecosystem needs are integrated with water management and project operations. (See Volume 2 Resource Management Strategies, Chapter 9 Ecosystem Restoration.)

California Water Plan Update 2005 presents a range of actual water conditions that have occurred in recent water years. Water year 1998 represents a recent wet year in California. Year 2000 is a representative average water year, and year 2001 provides a snapshot of a dry water year. (See Table 3-1 California water balance summary and Figure 3-5 California water balance [water source and applied water uses] for water years 1998, 2000, and 2001)

In average water years like 2000, California receives about 200 million acre-feet of water from precipitation and imports from Colorado, Oregon, and Mexico. Of this total supply, about 50 to 60 percent is either used by native vegetation, evaporates to the atmosphere, provides some of the water for agricultural crops and managed wetlands (effective precipitation), or flows to Oregon, Nevada, the Pacific Ocean, and salt sinks like saline groundwater aquifers and Salton Sea. The remaining 40 to 50 percent (denoted as dedicated supply) is distributed among urban and agricultural uses, used to protect and restore the environment, or stored in surface and

Box 3-1 continued from previous page

The federal government has long played a major role in development of the West's water resources. As early as 1875, the U.S. Army Corps of Engineers began work on the Sacramento and Feather rivers to improve navigation. In 1920, the U.S. Geological Survey proposed a comprehensive, statewide plan for conveyance and storage of California's water supplies. This plan served as the framework for an eventual State Water Plan, which later formed the basis for the federal Central Valley Project.

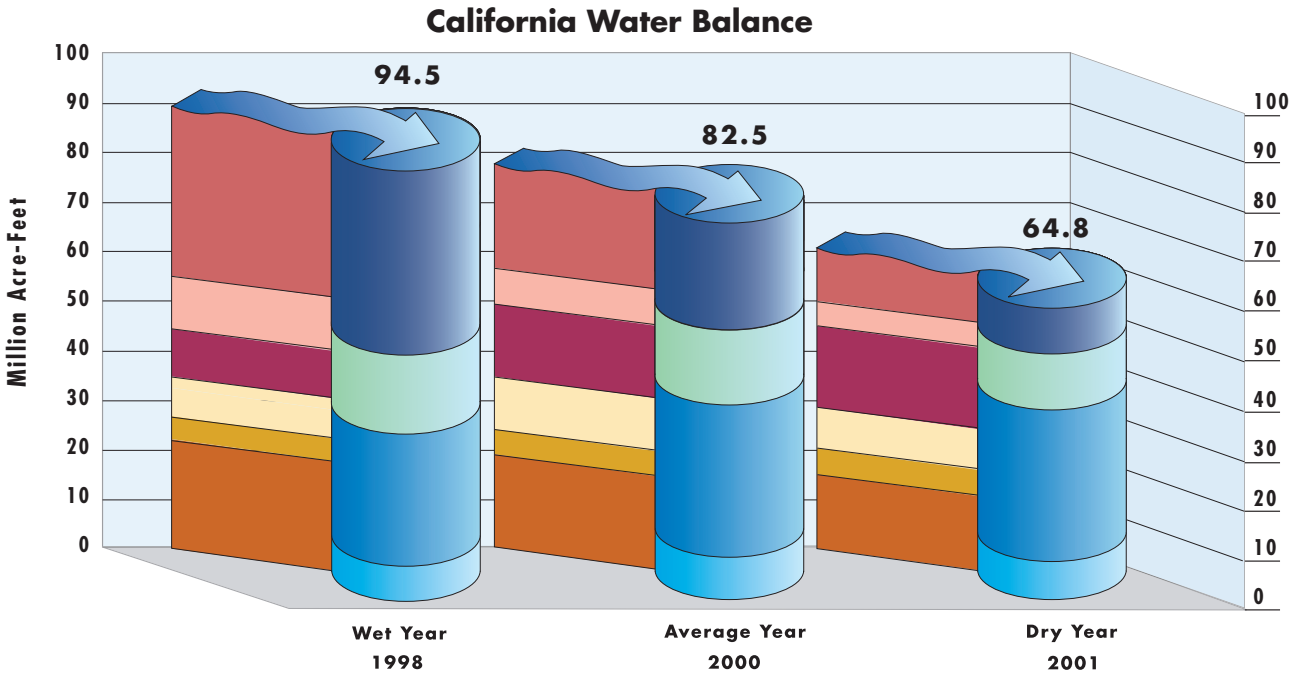
California's population doubled between 1940 and 1960. It appeared the state could not rely solely on federal or local sources to help meet future water needs. Water planners recognized the need for Delta improvement and for supplemental water to support growing southern California and prevent groundwater overdraft in the Central Valley. Additionally, the need for flood control on the Feather River was recognized, as was the San Joaquin Valley's need for an outlet for saline irrigation drainage for fields. After years of debate and study, the Porter-Burns Act and a $1.75 billion bond measure launched what was to become the State Water Project.

During the two decades following World War II, development of California's water was virtually unimpeded. But by the 1970s, environmental awareness had grown to an extent that environmental considerations came to be factored into the water supply equation. As a result of enactment of new laws, attention was focused on "instream use" of water to benefit fish and wildlife, recreation, water quality, and aesthetics—uses to which price tags cannot easily be attached. By 1990, these uses rivaled such traditional benefits as irrigation and navigation in importance. Such instream uses are recognized by the State constitution and Water Code as beneficial and must be considered in administrative decisions and in issuing water rights permits. Rising costs and the enactment of State and federal environmental legislation have resulted in few major water development projects being built since 1980.

Today hundreds of water utility districts supply Californians with water purchased by contract from the state or the federal government, bought wholesale from another water agency, or development with local resources. It is estimated that there are more than 3,700 public and private agencies in California dealing with some aspect of water supply, use, or treatment.

See also "A California Water Chronology" in Volume 4 Reference Guide.

Figure 3-5 California water balance for 1998, 2000, and 2001



California's water balance can vary significantly from year to year. Three recent years show a marked change in the amount and relative proportion of the following: water delivered to urban and agricultural sectors and water dedicated to the environment (applied water use); where the water came from (water source); and how much water was reused among sectors. Each year, applied water is only a portion of California's total precipitation and inflows. The rest—about 120 maf in an average year—either evaporates, is used by native vegetation, provides rainfall for agriculture and managed wetlands, or flows out of state or to salt sinks. (See Volume 3 for state and regional waterflow charts.)

groundwater reservoirs for later use. In any year some of the dedicated supply includes water that is used multiple times (reuse) and water stored from previous years. Ultimately, about a third of the dedicated supply flows to the Pacific Ocean (in part to meet environmental requirements) or to other salt sinks. Statewide, local surface water and groundwater supplies make up about 50 percent of California's total dedicated supply in an average water year (percentage varies regionally). Water also moves great distances in California within and between its 10 hyrological regions (see Figure 3-6 Regional inflows and outflows, year 2000 [an average water year]).

In wet and drier years, like 1998 and 2001, respectively, the total supply and the distribution of the dedicated supply to various uses differ significantly from the example above for an average year. For more information on the state's recent water supplies and uses, see Volume 3 Regional Reports, Chapter 1 State Summary.

Challenges

Californians continue to face a variety of water challenges, and State, federal, and regional agencies are meeting those

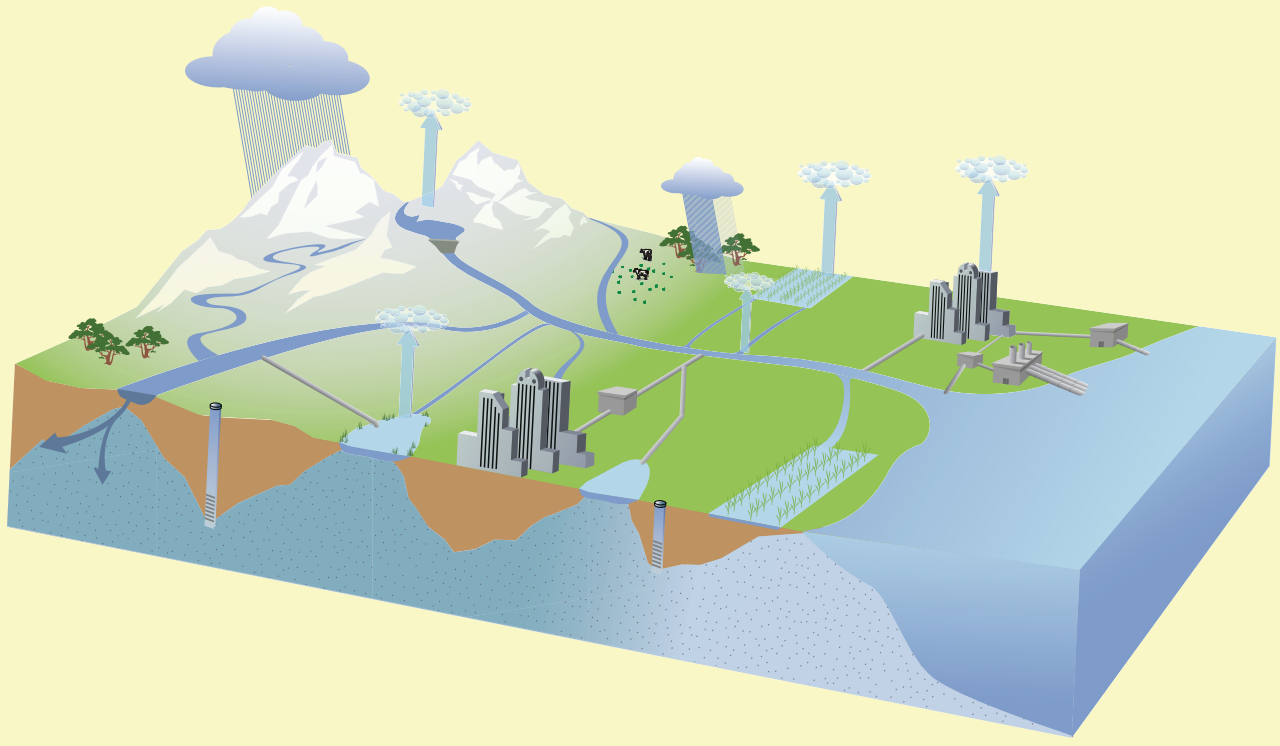
Table 3-1 California water summary (maf)

	1998 (171% of normal)[a]		2000 (97% of normal)[a]		2001 (72% of normal)[a]	
Total supply (precipitation & imports)	336.9		194.7		145.5	
Total uses, outflows, & evaporation	331.5		200.4		159.9	
Net storage changes in state	5.5		-5.7		-14.3	
Distribution of dedicated supply (includes reuse) to various applied water uses						
Urban uses	7.8	(8%)	8.9	(11%)	8.6	(13%)
Agricultural uses	27.3	(29%)	34.2	(41%)	33.7	(52%)
Environmental water[b]	59.4	(63%)	39.4	(48%)	22.5	(35%)
Total dedicated supply	**94.5**		**82.5**		**64.8**	

maf = million acre-feet

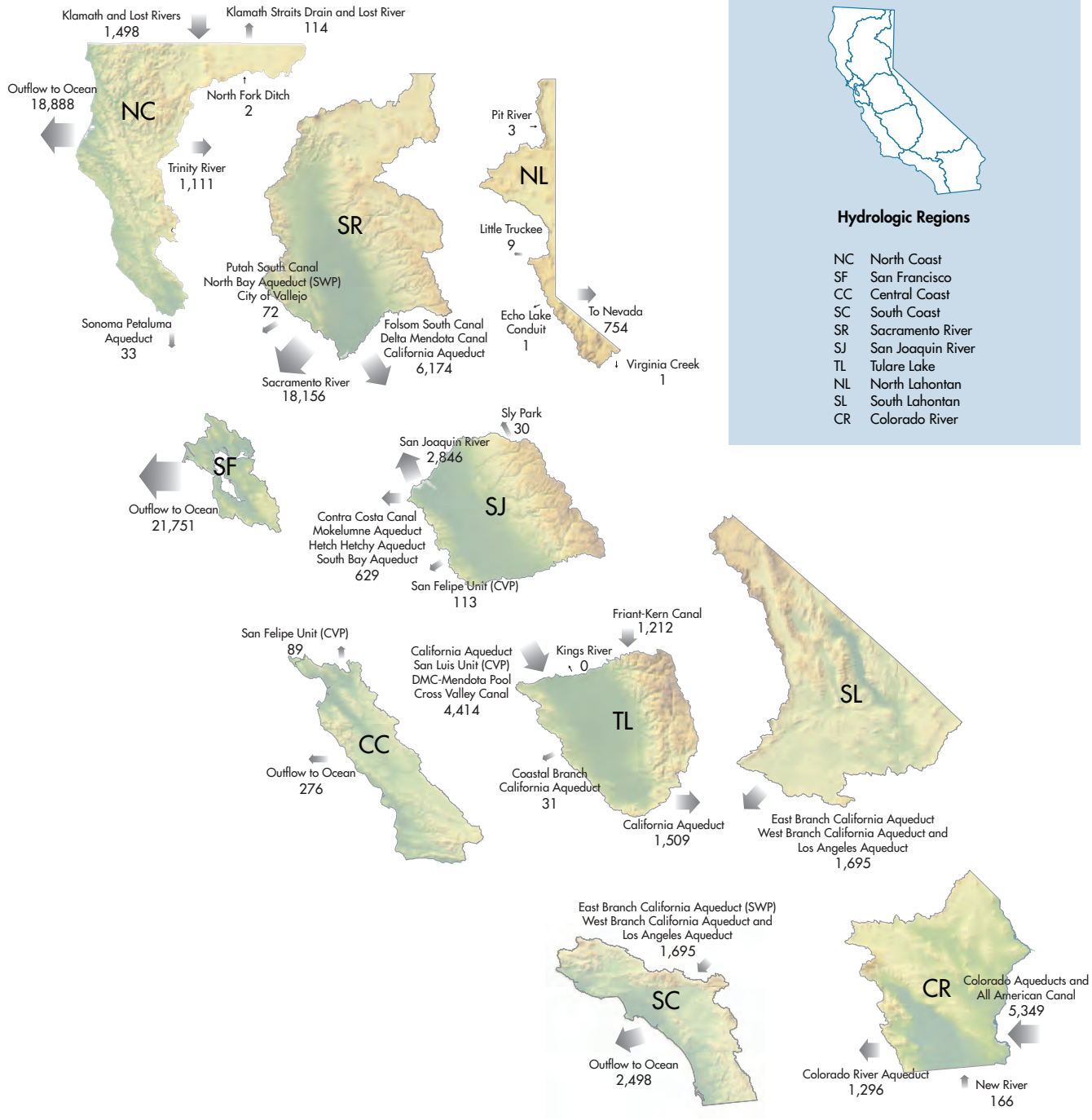
a. Percent of normal precipitation. Water year 1998 represents a wet year; 2000, average water year; 2001, drier water year.

b. Environmental water includes instream flows, wild and scenic flows, required Delta outflow, and managed wetlands water use. Some environmental water is reused by agricultural and urban water users.



Key components of the illustrated flow diagram are shown as characteristic elements of the hydrologic cycle. Volume 3 Regional Reports has flow diagrams for statewide water summary (in Chapter 1) and for regional water summaries in their respective chapters.

Figure 3-6 Regional inflows and outflows in TAF for year 2000 (an average water year)



Water moves great distances within and between California's 10 hydrologic regions, some through natural waterways and some through constructed water systems. Shown are the volumes of water in million acre-feet that flowed from one region to another in 2000, an average water year.

**Outflow to Ocean includes Wild and Scenic Rivers, regulated flows, and estimated wastewater outflows.*

challenges by responding with a variety of methods: task forces and advisory committees, partnerships and integrated regional water management, programs, water bonds, water management systems, research and reports, legislation, regulation, and more. (For further discussion, see the Response section that follows.)

The biggest challenge for California water resources management remains making sure that water is in the right places at the right time. This challenge is at its greatest during dry years: When water for the environment is curtailed sharply, less water is available from rainfall for agriculture and greater reliance on groundwater results in higher costs for many users. In the mean time, those who have already increased water use efficiency may find it more challenging to achieve additional water use reductions.

During the past 50 years, the growing water demands of many areas were met by large State, federal, and interregional projects that moved water significant distances across the state. Because of a variety of issues and uncertainties, new large, interbasin projects on the scale of the State Water Project (SWP) and the federal Central Valley Project (CVP) are less foreseeable in the near term. These State, federal, and local projects continue to serve as the backbone of California water management, and water supplies from these sources will incrementally increase. However, they will not, by themselves, provide for California's growing population and meet the State's agriculture production and environmental objectives.

The quality of California water is of particular and growing concern. Various water management actions potentially have water quality impacts. These include transfers, water use efficiency, water recycling, conjunctive use of aquifers, storage and conveyance, Delta operations, crop idling, and hydroelectric power. Degraded water quality can limit, or make very expensive, some water supply uses or options because the water must be pretreated. Furthermore, water managers increasingly recognize that the water quality of various water supplies needs to be matched with its eventual use and potential treatment. Overall, the State should develop and adopt an integrated "source-to-tap" strategy for meeting future water quality challenges.

As competition grows among water users, management of the water system becomes more challenging, complex, and at times contentious. Water issues are being resolved through coalitions and partnerships among government, public and private water suppliers, and users. Local, regional, State, and federal governments and water suppliers all have a role in assuring water resource sustainability and improving water supply reliability for the existing and future population and the environment.

Ongoing Concerns

Challenges persist for California water management at statewide, regional, and local levels. Significant statewide challenges that require improved water management are summarized here; a section on specific regional and local challenges follows.

Dry-Year Challenges

California has not experienced the hardships and environmental pressures of a prolonged statewide drought since the early 1990s, but similar or worse conditions of unreliable water supplies will recur. During long or extreme droughts, water supplies are less reliable, heightening competition and at times leading to conflicts among water users. Water quality is degraded, making it difficult and costly to make drinkable. Business and irrigated agriculture are adversely affected, jeopardizing California's economy. Ecosystems are strained, risking sensitive and endangered plants, animals, and habitats. Groundwater levels decline, and many rural residents who are dependent on small water systems or wells run short of water.

California's most severe recorded drought statewide occurred in 1976–1977. Two consecutive years with little precipitation (fourth driest and the driest year in recorded history) left California with record low storage in its surface reservoirs and dangerously low groundwater levels. Socioeconomic and environmental impacts were very severe during these extreme drought conditions. The total economic loss due to this drought exceeded $ 2.5 billion ($6.5 billion at today's cost).

The most recent prolonged statewide drought lasted 6 years from 1987 to 1992. During the drought's first 5 years, the groundwater extractions in San Joaquin Valley exceeded the recharge by 11 million acre-feet, which caused increased land subsidence in some areas. Department of Water Resources (DWR) studies indicate that in 1990–1992 the drought resulted in reduced gross revenues of about $670 million to California agriculture. Energy utilities were forced to substitute fossil fuel power for less costly hydroelectric power at an estimated statewide cost of $500 million in 1991. The drought also adversely affected snow-related recreation businesses; some studies suggest a financial loss of about $85 million during the winter of 1990–91.

The biggest challenge for California water resources management remains making sure that water is in the right places at the right time.

Data released in early February 2005 suggest a lessening of the drought that has been affecting the greater Colorado River Basin. The 5-year drought may have left conditions in this basin worse than that of the Dust Bowl years during the 1930s, according to Bureau of Reclamation Commissioner John Keys III (USBR 2003). The Colorado River is California's largest interstate water source and a significant source of hydroelectric power, and in 2004 the river's two major reservoirs, Lake Powell and Lake Mead, were expected to fall below 50 percent full.

During drought periods, some areas rely on interregional water transfers to supplement local water supplies. Meanwhile, concerns of groundwater overdraft and environmental impairment have led some counties to pass ordinances meant to control out-of-basin water transfers. State statute (Stats 2001, ch. 320, SB 672) requires that the California Water Plan describe water management tools and options that "will maximize resources and minimize the need to import water from other regions."

Water managers today use hydrologic records of the past century to estimate how climatic conditions would affect future water availability and water needs. Planners take into account the normal fluctuations of wet and dry years in allocating deliveries from reservoirs and in determining how much water will be provided from other sources. Public and private urban water suppliers must adopt urban water management plans[2] at least every five years (next updates are due by the end of 2005). These suppliers are those who provide water for municipal purposes either directly or indirectly to more than 3,000 customers or supply more than 3,000 acre-feet of water annually. The urban water management plan must include an analysis and a contingency plan for water supply reliability in case of a severe drought, which includes up to 50 percent reduction in water supply. Water management plans lay out shortage contingency scenarios that water agencies use as guidelines when reducing water use and augmenting short-term supply. Some of the tools that water districts use to plan against a multiyear drought are long- and short-term conservation measures, recycled water, water transfers, short-term sources of water, and long-term storage including conjunctive use.

In its July 2000 report, "Preparing for California's Next Drought," DWR reviewed items for near-term drought planning, putting California's conditions today into perspective with experiences gained in the 1987–1992 drought. Major findings of the report focused on the characterization of drought conditions as a gradual phenomenon and their impacts on water users.

The report also addressed the vulnerability of existing water users based on past droughts and discussed current actions that affect drought preparedness planning.

Since the drought of 1987–1992, many notable changes—increases in water demands, changes in regulations, and improvements in conservation and infrastructure—have occurred that will alter the impacts of future droughts. While developing drought management plans, planners must continue to consider changes like the following and determine the impact on their region.

- California's population has increased to about 36.5 million people as of July 1, 2004.
- The State Water Resources Control Board (SWRCB) adopted Decision 1630 in 1995, which requires higher flows to protect the Delta.
- The Central Valley Project Improvement Act of 1992 (Title 34 of PL 102-575) made significant changes to the CVP's legislative authorization, amending the project's purposes to place fish and wildlife mitigation and restoration on a par with water supply, and to place fish and wildlife enhancement on a par with power generation.
- Completion of construction of Coastal Aqueduct (DWR), Morongo basin pipelines (Mojave Water Agency), Diamond Valley Lake (Metropolitan Water District), Los Vaqueros Reservoir (Contra Costa Water District), and five large-scale groundwater recharge/storage projects should add flexibility in operating the water system.
- Despite the increase in population, advances in water conservation and recycling, combined with infrastructure improvements including new storage facilities, have helped meet most municipal and industrial demands. Cities use about the same amount of applied water today as they did in the mid-1990s, but accommodate 3.5 million more people.
- The Colorado River Quantification Settlement Agreement has been adopted, limiting California's access to Colorado River water.

People Without Clean and Safe Drinking Water

Census figures from 1990 indicate that in California almost 32,000 housing units obtained water from shallow wells and another 49,000 housing units obtained their water from some source other than dug wells, drilled wells, or public or private water systems. The Census counted about 68,000 housing units (less than 1 percent of the state's population) that disposed of their sewage by means other than a public sewer, septic tank, or cesspool.

[2] Required by the California Urban Water Management Planning Act (Water Code, ch.1, §§ 10610—10610.4)

Californians lacking access to clean and safe drinking water are vulnerable to a higher incidence of disease than is the general population. Untreated water can contain bacterial, parasitic, and viral contaminants. People at risk most often get their water from untreated surface water such as rivers, lakes, or springs. They may also have shallow unsealed wells or use irrigation ditch water. Surface water and shallow wells can become contaminated from rain runoff or flooding. A further concern is sewage disposal. Many rural communities have problems associated with failing septic drainfields and sewage surfacing in yards. This lack of wastewater infrastructure may cause cross-contamination with potable water (see Volume 4 Reference Guide article "Californians Without Safe Water").

Contamination of Surface Water and Groundwater

Nonpoint-source pollution, including urban and agricultural runoff, is the largest contributor of human-induced contamination of surface water and groundwater in the state. Regarding surface water, about 13 percent of the total miles of California's rivers and streams and about 15 percent of its lake acreage are listed as impaired. Regarding groundwater, samples analyzed from all 10 hydrologic regions showed that 5 to 42 percent of public water supply wells exceeded one or more drinking water standards, depending on the region. The exceedance was usually for inorganic chemicals or radioactivity and, in particular, nitrate, which presents a known health risk. Largely agricultural or industrial regions had high percentage of exceedances for pesticides and volatile organic chemicals, respectively. Seawater intrusion in the Delta and in coastal aquifers, agricultural drainage, and imported Colorado River water can increase salinity in all types of water supplies, adversely affecting many beneficial uses.

Groundwater Overdraft

Overdraft is the condition of a groundwater basin in which the amount of water withdrawn by pumping over the long term exceeds the amount of water that recharges the basin. Overdraft is characterized by groundwater levels that decline

Box 3-2 Critical Conditions of Overdraft

In 1978, the Department of Water Resources was directed by the legislature to develop a definition of critical overdraft and to identify those basins in a critical condition of overdraft (Water Code §12924). DWR held public workshops around the State to obtain public and water managers' input on what the definition should include and which basins were critically overdrafted. Bulletin 118-80, Ground Water Basins in California was published in 1980 with the results of that local input. The definition of critical overdraft is:

> A basin is subject to critical conditions of overdraft when continuation of present water management practices would probably result in significant adverse overdraft-related environmental, social, or economic impacts.

No time is specified in the definition. Definition of the time frame is the responsibility of the local water managers, as is the definition of significant adverse impacts, which would be related to the local agency's management objectives.

Eleven basins were identified as being in a critical condition of overdraft. They are:

Pajaro Basin
Ventura Central Basin
Chowchilla Basin
Kings Basin
Tulare Lake Basin
Kern County Basin
Cuyama Valley Basin
Eastern San Joaquin County Basin
Madera Basin
Kaweah Basin
Tule Basin

The task was not identified by the Legislature, nor was the funding for Bulletin 118 update (2003) sufficient to consult with local water managers and fully re-evaluate the conditions of the 11 critically overdrafted basins. Funding and duration were not sufficient to evaluate additional basins with respect to conditions of critical overdraft. (From DWR 2003 Bulletin 118 Update)

over a period of years and never fully recover, even in wet years. Overdraft can lead to increased extraction costs, land subsidence, water quality degradation, and environmental impacts. A comprehensive assessment of overdraft in California's groundwater basins has not been conducted since 1980 (DWR 1980). It is estimated that overdraft is between 1 million and 2 million acre-feet annually (DWR 2003 Bulletin 118), but the estimate is only tentative with no current corroborating data. (See Box 3-2 Critical Conditions of Overdraft.)

In some cases the term overdraft has been incorrectly used to describe a short-term decline in groundwater in storage during a drought, or to describe a one-year decline of groundwater in storage. A one-year decrease of the amount of groundwater in storage is an annual change in storage and does not constitute overdraft. During a drought the aquifer is being used as a reservoir, and water is being withdrawn with the expectation that the aquifer will be recharged during a wet season to follow.

Deferred Maintenance and Aging Facilities

California depends on vast statewide water management systems to provide clean and reliable water supplies, protect lives and property from floods, withstand drought, and sustain environmental values. These water management systems include physical facilities and their operational policies and regulations. Facilities include over 1,200 State, federal, and local reservoirs, as well as canals, treatment plants, and levees. Systems are often interconnected. The operation of one system can depend on the smooth operation of another. The successful operation of the complete system can be vulnerable if any parts fail.

California's facilities require costly maintenance and rehabilitation as they age. In addition, they face many challenges: meeting the needs of a growing population and changing water use patterns, withstanding catastrophic natural events like earthquakes and floods, and adapting to the changes that accompany global climate change. Bottlenecks develop when physical and operational changes of existing water management systems do not keep pace with changes in capacity, regulations, and new environmental data.

Aging facilities risk public safety, water supply reliability, and water quality. The SWP is more than 30 years old; the federal CVP is more than 50 years old. Some local facilities were constructed nearly a 100 years ago. Current infrastructure disrepair, outages, and failures and the degradation of local water delivery systems are in part the result of years of underinvestment in preventive maintenance, repair, and rehabilitation. The Public Policy Institute of California estimated the state's water supply and wastewater treatment systems maintenance backlog to be about $40 billion (Dowall and Whittington 2003).

Flood Management

California's Central Valley flood control facilities are deteriorating and, in some places, literally washing away. Flood events in 1986, 1995, and 1997 cost lives, billions of dollars in property and economic losses, and caused severe disruptions to public infrastructure. At the same time, the Central Valley's growing population is pushing new housing and job centers to areas that are particularly vulnerable to flooding. Yet, in recent years, funding to maintain and upgrade flood protection facilities has sharply declined. Compounding these challenges are recent court rulings that hold State and local agencies liable for flood-related damages when levees fail (for details, see "Flood Warnings: Responding to California's Flood Crisis," DWR January 2005).

Delta Vulnerabilities

The Sacramento-San Joaquin Delta is the hub of California water management and a vital aquatic ecosystem. Flows from the Sacramento, San Joaquin, Calaveras, Cosumnes, and Mokelumne rivers run through the Sacramento San-Joaquin Delta. These rivers and the channels and levees within the Delta are some of the major water conveyance systems of California. They are interconnected, and failure of one part of the network affects operations throughout the network. Failing infrastructure leads to unreliable, poor-quality, and expensive water supplies.

The common denominator among pursuits in the Delta is the levee system. These levees protect water supplies needed for the environment, agriculture and urban uses. Despite their importance, many factors make it challenging to sustain the Delta levees. Subsidence of Delta islands continues to occur where peat soils oxidize, increasing the pressure on levees that protect the islands. A catastrophic earthquake in or near the Delta might cause multiple levee failures that would draw seawater into the Delta, rendering the water unfit for irrigation or human consumption until levees were repaired and seawater was flushed from the Delta. Climate change is causing sea levels to rise and may also increase the magnitude of flooding. Maintenance and improvement of Delta levees is costly, and available funds have not kept pace with needs. Levee failures are extremely costly to repair, further burdening the ability to fund adequate maintenance and rehabilitation.

On June 3, 2004, a levee breach occurred on Upper Jones Tract in the southern region of the Delta. A roughly 300-foot wide section collapsed. There was no warning, the time was outside the normal flood season, and it was a nonproject area. Seawater flooded about 12,000 acres of farmland and pulled salty water into the Delta, the major drinking water source for more than 23 million Californians. Responding agencies held concerns about risks to State Highway 4 and nearby islands and the Kinder-Morgan gasoline pipeline.

The breach demonstrates the vulnerability of the Delta levees, which are needed for the environment, agriculture, and urban uses. These levees protect roadways, cities, towns, agricultural lands, as well as terrestrial and aquatic habitat. The CALFED Delta levee program is intended to reduce the risk of catastrophic breaching of these levees.

Also, recent studies have alerted the water community to low levels of Delta/Suisun Bay pelagic fish (delta smelt, longfin smelt, threadfin shad, and striped bass). The decrease was unexpected given the relatively moderate hydrology over the past three years. Three general factors may be acting individually or in concert to lower pelagic productivity: (1) toxins, (2) invasive species, and (3) water project operations. The Interagency Ecological Program has undertaken an aggressive interdisciplinary, multi-agency study to evaluate these factors and consider possible responses. The work falls into four general tasks: (1) an expansion of existing monitoring, (2) analyses of existing data, (3) ongoing studies, and (4) new studies. (See Box 3-3 Delta Pelagic Fish Decline.)

Global Climate Change

California's water systems have been designed and operated based on data from a relatively short hydrologic record. Mounting scientific evidence suggests that forecasted climate changes could significantly change California's precipitation pattern and amount from that shown by the record. Less snowpack would mean less natural water storage. More variability in rainfall, wetter at times and drier at times, would place more stress on the reliability of existing flood management and water systems. California's high dependence on reservoir storage and snowpack for water supply and flood management makes us particularly vulnerable to these types of projected hydrologic changes. (See Chapter 4 in this volume and articles in Volume 4 Reference Guide under Global Climate Change for further discussion.)

Historical records reveal changes in the pattern of April–July runoff; an example is plotted here for the Sacramento River (Figure 3-7 Sacramento River April-July runoff in percent of water year runoff). From the 1950s to the present, the percentage of April–July runoff has shown a progressive decline.

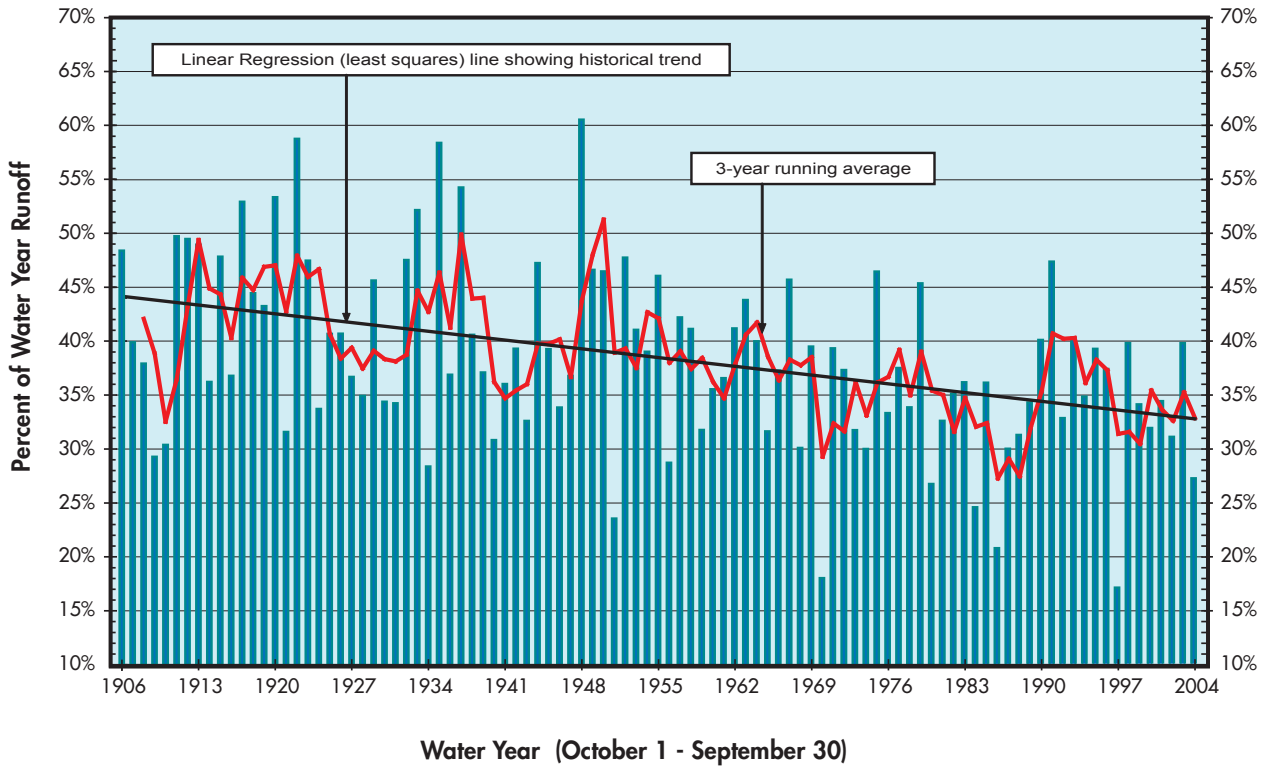
Global climate change is already leading to sea level rise. Figure 3-8 (Golden Gate annual average and 19-year mean tide levels) shows historical sea level rise at the Golden Gate. During the 20th century, sea levels increased by 0.2 meters (0.7 feet). During the 21st century, models project a median rise of 0.5 meters (1.6 feet) due to climate change (IPCC 2001). This could eventually disrupt ecosystems and communities in coastal areas and ongoing tidal wetland restoration. The biggest impact of sea level rise on California water supply could

Box 3-3 Delta Pelagic Fish Decline

A recent (2002-2005) decline in estimates of several pelagic (open water spawning) fish species in the Sacramento-San Joaquin Delta, referred to as the pelagic organism decline (POD), has raised concern about the resiliency of the Delta aquatic ecosystem. Species potentially at increased risk include threadfin shad (Dorosoma petenense), striped bass (Morone saxatilis), longfin smelt (Spirinchus thaleichthys), and the federally and State-listed endangered delta smelt (Hypomesus transpacificus).

As part of a multi-agency effort aimed at establishing potential causes of and identifying an appropriate research strategy to further characterize the POD, the CALFED Science Program, in collaboration with the Interagency Ecological Program (IEP), convened a panel of independent scientists to provide a review of the IEP data synthesis associated with the 2005 IEP POD work plan. The independent review panel will also review the 2006 draft IEP POD work plan and provide recommendations relevant to continued POD investigations. This independent panel will address the need for appropriate peer review for CALFED Science Program-associated activities as outlined in the CALFED 2000 Programmatic Record of Decision.

Figure 3-7 Sacramento River April - July runoff in percent of water year runoff



Historical records reveal changes in runoff pattern from April through July in a number of California rivers. Since the 1950s, the percentage of total annual runoff occurring during these months has declined progressively, an indication of earlier snowmelt and warmer temperatures.

be in the Delta where sea level rise would increase pressure on the levees that protect low-lying lands, much of which already is below sea level.

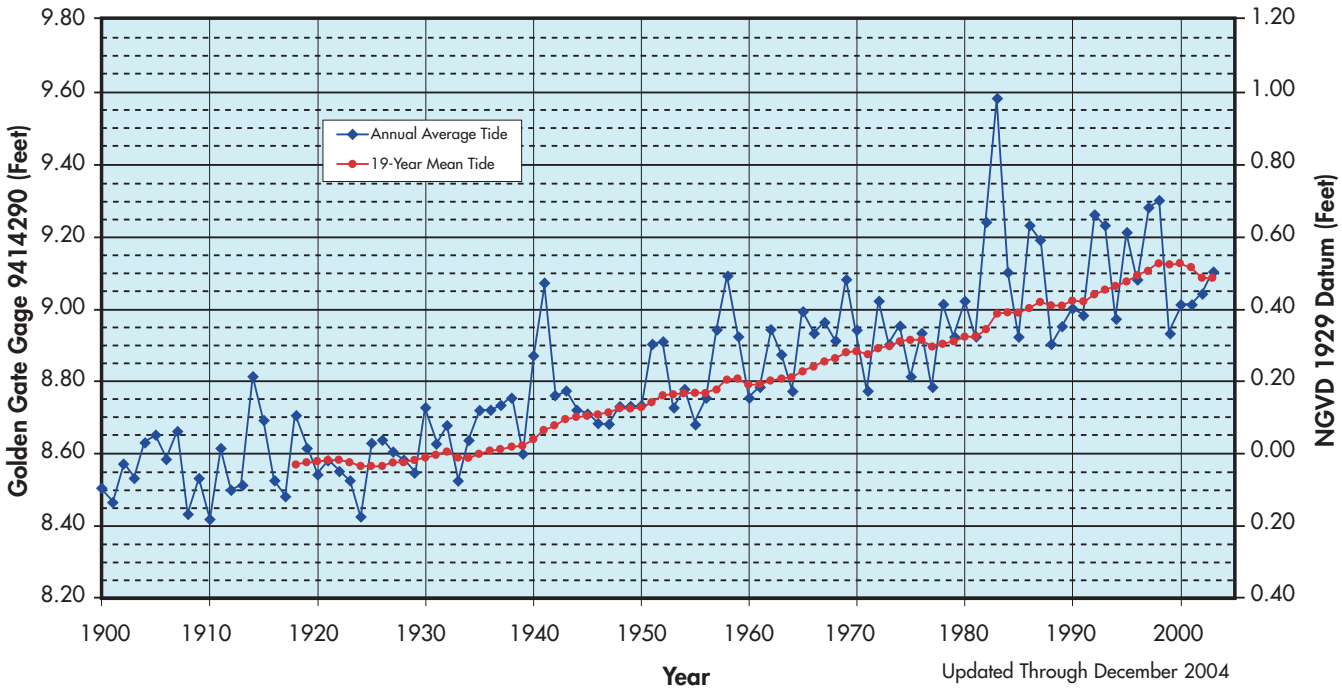
Water and Energy

Water and energy are two resources that are inherently linked, especially in California. Taken together, pumping, treating, and distributing potable water, groundwater pumping, desalination, heating and cooling processes, pressurization, and the collection, treatment, recycling, and discharge of wastewater, consume approximately 20 percent of the state's total electricity, 30 percent of the natural gas, and 88 million gallons of diesel. Some water systems are net energy producers, for example, the federal CVP as well as San Francisco's Hetch Hetchy and the Los Angeles Aqueduct water systems. Others are net energy consumers, for example, Metropolitan Water District's Colorado River Aqueduct and the SWP. In fact, the SWP is the single largest user of electricity in the state, although the project produces about half of the energy it consumes.

Just as water and energy are inherently linked, so are water and energy efficiencies. For instance, improvements in water use efficiency related to washers and shower heads inevitably lead to energy efficiency benefits related to water heating. On the other hand, some energy- and water-efficiency measures are inversely related (for example, the need to pressurize drip irrigation systems may require more on-form energy per unit of water). Distributed water and wastewater treatment and reuse facilities could also reduce energy use in the water sector, by treating water and wastewater on-site for use (and reuse) locally, thereby decreasing the need for transporting (pumping) water to and from existing regional treatment facilities.

In general, water use in the municipal and industrial sector is more energy intensive than in the agricultural sector because surface water used for irrigation usually takes advantage of gravity flow and only a small percentage flows to waste water treatment plants after being used. In Southern California importing water is by far the largest use of electricity for a typical water system, and the total energy used to get water

Figure 3-8 Golden Gate annual average and 19-year mean tide levels



Global climate change is already leading to sea level rise, which can disrupt coastal communities, ecosystems, and tidal wetland restoration. It can also increase pressure on Delta levees, whose failure would disrupt water supply for about two-thirds of the state's residents and about one-half of its irrigated agriculture.

to a typical Southern California home (from source to tap) can be the second or third largest household electrical use. In response to the recent energy crisis, the State has sited some new power plants, often using fresh water for cooling and sometimes in water-scarce regions. This can potentially impact local water supplies through both diversion and discharge. (See Box 3-4 Hydroelectric Facilities.)

DWR has assisted the California Energy Commission (CEC) with updating the water resource-related portions of the 2005 Integrated Energy Policy Report. A draft IEPR was released in September 2005, and the final report is expected by the end of November 2005. Chapter 8 of the draft, titled Integrating Water and Energy Strategies, provides an assessment of current water-energy relationships as well as policy guidance regarding future water-energy management strategies. DWR also contributed to the development CEC's Water-Energy Relationship Study (WERS). The WERS provides details and information that support recommendations published in the IEPR. The final WERS is expected in by the end 2005. The commission's Web link to the IEPR update process is www.energy.ca.gov/2005_energypolicy/.

Tribal Water Rights

In the more arid western areas of the United States, including California, state water rights framework and federal Reclamation Act policies have evolved over the past 100 years largely without regard to water resources reserved for tribal lands. Tribal water rights to meet economic and cultural needs are often encroached upon or unmet. Unlike previous water plan updates, this update recognizes tribal water needs and suggests ways to engage tribal interests in California water planning and program and project implementation.

Environmental Justice

Californians from disadvantaged and under-represented communities continue to face economic and environmental inequities with respect to water supply, participation in water policy and management decisions, and access to State funding for water projects. All Californians do not have equal opportunity or equal access to State planning processes, programs, and funding for water allocation, improving water quality, and determining how to mitigate potential adverse impacts to communities associated with proposed water programs and projects. (See Volume 4 Reference Guide article "Environmental Justice in California Government.")

Regional/Local Challenges

Following is a summary of challenges faced by California's 10 hydrologic regions, a Mountain Counties overlay area, and the Delta (see Figure 3-9 Map of California's 10 hydrologic regions, the Delta, and Mountain Counties and Box 3-5 Description of California's 10 Hydrologic Regions, the Delta, and Mountain Counties). (See Volume 3 Regional Reports for more discussion of each region's challenges, a sampling of their management plans, and regional water balance summaries.)

North Coast Hydrologic Region

Water supply reliablity. The Klamath River Basin is an interstate watershed with surface storage facilities in both California and Oregon, and competing water needs for agriculture, tribal water rights, waterfowl refuges, and endangered fish. In the U.S. Bureau of Reclamation (USBR) Klamath River Project, environmental and agricultural demands compete for limited water in dry years. During the recent dry period from years 2001 through 2004, the lack of water in storage severely affected agricultural diversions and total crop acreage. The low flows in the river and associated warm water temperatures also contributed to significant reduction of the salmon population.

In the Trinity River system the need for downstream flows for fish versus water diversions to the Sacramento River basin has resulted in litigation and a revised operations plan at the USBR Lewiston Reservoir diversion. Recent federal court decisions allocate more water for Trinity River fish populations, but the timing and volume of these increased releases remain controversial.

Box 3-4 Hydroelectric Facilities

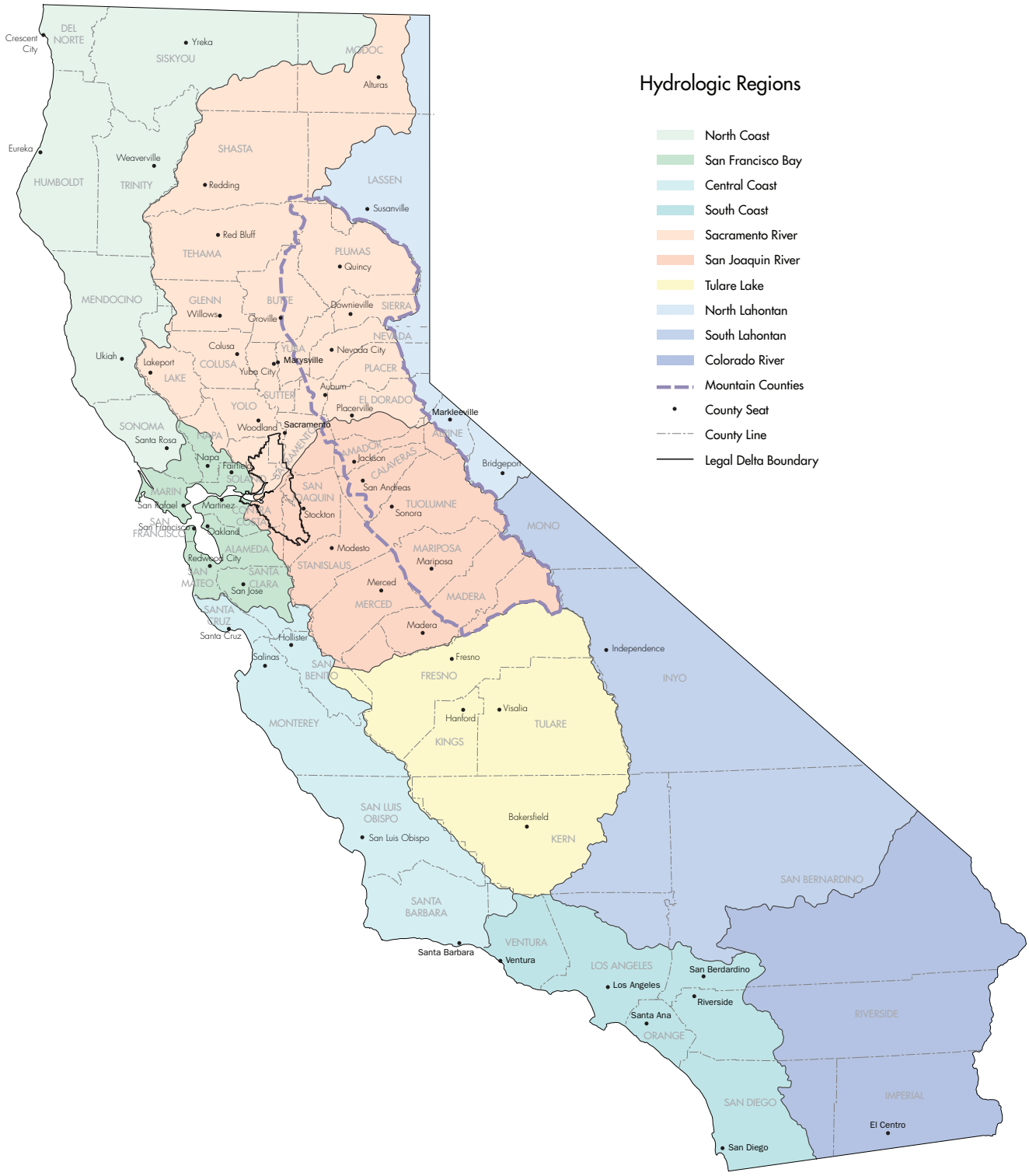
Hydroelectric facilities account for approximately 25 percent of California's electricity production capacity and on average produce about 15 percent of the state's electricity, with relatively low production costs, no greenhouse gas emissions, and the ability to meet critical peak demands. Because hydropower obviously depends on water for fuel, hydroelectric output is quite variable, ranging from 9 to 30 percent in terms of electricity sales during the period 1983 to 2002.

Unlike most of the United States, California hydropower is characterized by numerous low-volume, high-head (large elevation drop) facilities, that divert water from rivers into forebays and then into penstocks and powerhouses. The Central Valley is the state's most important hydropower region because of its considerable generating and water storage capacities. California is also dependent upon hydropower generated in the Pacific Northwest and on the Colorado River. Compared to the Columbia Basin, large and extensive reservoir storage in California provides greater reliability to the state's hydropower capability, making this energy source less vulnerable to single-year droughts.

Along with the development and benefits of hydroelectric facilities in California have come environmental impacts. Dams have significantly changed river flows, stages, and temperatures and created barriers to fish passage, impacting two-thirds of the state's freshwater fish species. In the North Coast, hydropower facilities blocked a significant amount of historical spawning grounds for salmonids. A symptom of peaking power production, which in itself is a distinct benefit of hydropower, is fluctuating water levels downstream of dams, which can strand downstream migrating salmonid fry as well as upstream migrating adults and their redds. The California Energy Commission has concluded that decommissioning low energy production-high environmental impact hydropower facilities may be an economically viable way to restoring ecosystems.

Hydroelectric projects are licensed by the Federal Energy Regulatory Commission (FERC), and the licenses of more than 100 existing facilities in California will be up for federal license renewal within the next 10 years. As part of the FERC license renewal process, the project owners must conduct studies to evaluate the future use, impacts, and alternatives for each hydroelectric project. For local water agencies this relicensing process will provide key opportunities to develop and improve integrated resource planning, so that the proposed operation of hydroelectric projects can also consider improved benefits to local water supplies, instream flows, and recreation uses.

Figure 3-9 Map of California's 10 hydrologic regions, the Delta, and Mountain Counties



The California Department of Water Resources divides the state into 10 hydrologic regions that correspond to its major drainage basins. This water plan update also describes the Mountain Counties and Sacramento-San Joaquin Delta as two overlay areas of special interest.

Box 3-5 Description of California's 10 Hydrologic Regions, the Delta, and Mountain Counties

The Department of Water Resources subdivides the state into regions for planning purposes. The largest planning unit is the hydrologic region. California has 10 hydrologic regions corresponding to the state's major drainage basins. This water plan update also includes the Sacramento – San Joaquin Delta and the Mountain Counties overlay area.

Hydrologic Regions

North Coast. Klamath River and Lost River Basins, and all basins draining into the Pacific Ocean from the Oregon stateline southerly through the Russian River Basin.

San Francisco Bay. Basins draining into San Francisco, San Pablo, and Suisun bays, and into Sacramento River downstream from Collinsville; western Contra Costa County; and basins directly tributary to the Pacific Ocean below the Russian River watershed to the southern boundary of the Pescadero Creek Basin.

Central Coast. Basins draining into the Pacific Ocean below the Pescadero Creek watershed to the southeastern boundary of Rincon Creek Basin in western Ventura County.

South Coast. Basins draining into the Pacific Ocean from the southeastern boundary of Rincon Creek Basin to the Mexican boundary.

Sacramento River. Basins draining into the Sacramento River system in the Central Valley (including the Pit River drainage), from the Oregon border south through the American River drainage basin.

San Joaquin River. Basins draining into the San Joaquin River system, from the Cosumnes River basin on the north through the southern boundary of the San Joaquin River watershed.

Tulare Lake. The closed drainage basin at the south end of the San Joaquin Valley, south of the San Joaquin River watershed, encompassing basins draining to Kern Lakebed, Tulare Lakebed, and Buena Vista Lakebed.

North Lahontan. Basins east of the Sierra Nevada crest, and west of the Nevada stateline, from the Oregon border south to the southern boundary of the Walker River watershed.

South Lahontan. The closed drainage basins east of the Sierra Nevada crest, south of the Walker River watershed, northeast of the Transverse Ranges, north of the Colorado River Region. The main basins are the Owens and the Mojave River Basins.

Colorado River. Basins south and east of the South Coast and South Lahontan regions; areas that drain into the Colorado River, the Salton Sea, and other closed basins north of the Mexican border.

Overlay Areas

Sacramento-San Joaquin Delta. The Legal Delta includes about 740,000 acres of tidally influenced land near the confluence of the Sacramento and San Joaquin rivers. While it occupies portions of the Sacramento, San Joaquin, and a small part of the San Francisco hydrologic regions, the Delta is described as an overlay area because of its common characteristics, environmental significance, and its important role in the State's water systems.

Mountain Counties. The Mountain Counties region includes the foothills and mountains of the western slope of the Sierra Nevada and a portion of the Cascade Range. The area includes the eastern portions of the Sacramento River and San Joaquin River hydrologic regions. This area shares common water and other resource issues and is the origin for much of the State's developed surface water supply.

Water quality. Erosion and runoff from logging, rural roads, agriculture (including grazing), and cities cause sedimentation that can adversely affect rivers and streams, including habitat for spawning and rearing of anadromous fish, and contaminate growing areas for shellfish. Water diversions, channel modification, temperature, and nutrients have also impacted commercial and recreational fisheries. Groundwater quality problems include seawater intrusion and nitrate contamination in shallow coastal aquifers, salinity and alkalinity in the lake sediments of Modoc Plateau basins, and iron, boron, and manganese in the inland basins of Mendocino and Sonoma counties. Septic tank failures in western Sonoma County are a concern for recreation-water quality in the Russian River; boating fuel constituents from recreational activities are pollution concerns in Trinity, Lewiston, and Ruth lakes.

Environmental water supply. A primary water management issue in the North Coast Hydrologic Region centers around balancing water demands of both agriculture and fish in the Klamath River Basin and its largest tributary, the Trinity River. Water supplies for farmers in the basin have been reduced because of habitat restoration for endangered species such as the Lost River and shortnose suckers, coho salmon, and steelhead trout. In 1997 the National Marine Fisheries Service listed steelhead trout as threatened and in 2002 listed coho salmon as endangered along part of the California coast that includes the Russian River Basin.

The region must also balance Eel River fishery restoration needs with existing basin exports to the Russian River through Pacific Gas and Electric's Potter Valley Project. The 2004 decision to amend the power license with a 15 percent export reduction is being litigated in federal courts.

San Francisco Bay Hydrologic Region

Water supply reliability and water quality. Some of the major challenges of this region include improving water supply reliability during drought periods and after earthquakes. More than 65 percent of the region's surface water is imported from other regions, and many aging water delivery systems are vulnerable to earthquake damage. San Francisco is planning a $4.3 billion upgrade of the Hetch Hetchy water transmission system, while Contra Costa Water District is studying an alternate point of water diversion for its Contra Costa Canal intake from the Delta. To reduce water system risk regional water agencies continue to plan and construct water facility upgrades, replacements and interconnections between the different systems. The quality of San Francisco Bay Area drinking water supplies varies by source and method of treatment. Agencies are continuously pursuing activities that will improve water quality, such as groundwater conjunctive use, improved treatment technology, and blending of water from alternate sources of supply. Other challenges include the expansion of integrated regional planning efforts, in order to link local land use planning with water system planning and management.

Environmental water supply. Environmental water quality issues naturally focus on the San Francisco Bay Estuary, including control of storm water, urban runoff, sediment, and pollutants from local watersheds as well as the Central Valley and Delta watersheds. Water quality in the estuary is better than in previous decades due to the implementation of secondary treatment of domestic wastewater. However, sediment deposits in the estuary are still widely contaminated by legacy pollutants such as mercury and polychlorinated biphenyls, which contaminate fish.

Central Coast Hydrologic Region

Water supply reliability. With a limited surface water supply and few surface water storage facilities, the region increasingly depends on imported water and groundwater resources. Surface water for agricultural and urban purposes is imported through the federal CVP San Felipe project (in the northern region) and via the SWP Coastal Branch Aqueduct to San Luis Obispo and Santa Barbara counties (in the south). For the Salinas River and the Monterey Peninsula, future sources of water supply are being studied from recycling, conjunctive management, and desalination.

In 1995 SWRCB ruled that California-American Water Company, the primary water supplier to most of the Monterey Peninsula, did not have a legal right to about 70 percent of the water it takes from the Carmel River, its main source. In response Cal-Am has been taking more water from wells that draw from groundwater below the lower valley, while evaluating new alternative sources of water supply.

Environmental water supply and water quality. Sedimentation poses the greatest water quality threat to Morro Bay, one of 28 estuaries in the National Estuary Program. The primary tributary to Monterey Bay, the Salinas River watershed, suffers from nitrate and pesticide contamination related to agriculture, which is the valley's main land use. Seawater intrudes up to 6 miles inland in the shallow aquifer around Castroville. The nearby Pajaro River watershed faces a variety of water quality threats such as erosion, urban runoff, sand and gravel mining, flood control projects, off-road vehicles, and historical mercury mining in the Hernandez Lake area.

South Coast Hydrologic Region

Water supply reliability. Projected population increases will have a significant impact on water demands. More than 50 percent of the region's water supplies are imported from other parts of the state through the SWP, the Los Angeles Aqueduct, and the Colorado River Aqueduct. By year 2016 California's Colorado River allocation will be reduced from the current 5.3 million acre-feet per year to 4.4 million acre-feet per year. Several water exchange, conjunctive use, and conservation programs must be developed to offset this reduction. Drought impacts are a long-term concern and require the development of other local sources of supply to meet dry year demands, including recycling, expanded conservation, conjunctive use, and desalination.

Water quality. Population growth (to more than 23 million residents by year 2030) and associated urban sprawl will present several water quality challenges, including the need for treatment facilities for the increased wastewater and urban runoff. Storm water, urban runoff, and overflows from sanitary sewers can adversely affect coastal water quality, causing beach closures and swimming restrictions. Extensive shipping and recreational boating can also affect ocean water quality. Imported surface water supplies have water quality problems including high levels of total dissolved solids (TDS) and low levels of perchlorate from the Colorado River, and the presence of organic carbon and bromide in SWP Delta supplies. In particular, high TDS levels in source water can inhibit wastewater reuse. Salinity also intrudes into local groundwater basins near the ocean, which is respulsed by hydraulic groundwater barriers in Los Angeles and Orange Counties. Inland, some local aquifers are polluted by MTBE, perchlorate, chromium 6, and organic chemicals. A large concentration of dairies in the Chino Basin has led to salt, nutrient, and microbial contamination of groundwater. The Los Angeles, San Gabriel, and Santa Ana Rivers are the focus of many watershed planning and restoration activities.

Sacramento River Hydrologic Region

Water supply reliability and water transfers. During extended periods of drought, surface water allocation cutbacks from the SWP and the CVP limit water districts reliant on these supplies. Agricultural users turn to groundwater, switch to lower water-use crops, or allow prime farmland to lie fallow. With a growing demand for high quality water throughout the state, water transfers from Sacramento Valley to other parts of the state are evaluated more closely. Several counties have adopted groundwater ordinances that regulate or impede water transfers outside of the county of origin.

DWR and USBR, under the CALFED Bay-Delta Program and in cooperation with the California Bay-Delta Authority (CBDA), are studying the feasibility of two proposed surface storage improvements within this region: the enlargement of Shasta Reservoir and a new offstream storage reservoir on the west side of the Sacramento River called Sites Reservoir. Flood protection and the adequacy of existing flood control structures is a major concern for the low-lying areas of the Sacramento Valley floor, particularly in areas where urban expansion is occurring.

Water quality. Much of the region's groundwater and surface water are of high quality, but there are some local groundwater problems, from natural contaminant sources and past industrial processes. For instance, at the north end of the Sacramento Valley, wells typically have high TDS content and in the western volcanic and geothermal areas, moderate levels of hydrogen sulfide are found in groundwater In the Sierra foothills, uranium and radon-bearing rock or sulfide mineral deposits containing heavy metals may contaminate groundwater. In addition, a history of gold mining activities has produced a legacy of mercury, especially in the Cache Creek watershed, and other toxic heavy metals in surface water supplies. Water temperature is a concern in the Sacramento River and its tributaries that provide habitat for four runs of salmon. Along the lower American River, a plume of perchlorate contamination spreads, causing closure of several municipal wells in the vicinity.

Environmental water supply. Additional ecosystem protection and restoration efforts are needed to continue improving habitat for threatened and endangered species while maintaining water quality on tributaries that flow into the Sacramento River and eventually into the Delta. Existing and proposed projects include federal and State partnerships with landowners, agricultural water districts, Pacific Gas and Electric Company, and several other entities in the region.

San Joaquin River Hydrologic Region

Water supply reliability. Plans to restore the river habitat and fish populations on the San Joaquin River through higher releases of water from Friant Dam have spurred growing concerns over the long-term availability of the Sierra water supplies for the San Joaquin River. USBR, in cooperation with CBDA, is studying the feasibility of a new surface storage reservoir in the upper San Joaquin basin, with the primary location identified as Temperance Flat.

Extensive groundwater pumping in the Stockton area has generated groundwater overdraft, leading to declining groundwater levels and saline groundwater intrusion. A groundwater recharge program that is under development would divert surplus river water during winter months to help restore groundwater levels and stop the saline groundwater intrusion.

Water quality. The major surface water quality problems of San Joaquin Valley streams are a result of depleted freshwater flows, significant salt and other pollutant loads from agricultural runoff and wetland drainage, and municipal and industrial wastewater discharges. Dairies, stockyards, and poultry ranches are also a concern in the region for their loadings of pathogens, nutrients, salts, and emerging contaminants (such as antibiotics) to water bodies. High salinity groundwater can be found along the western edge of the valley floor where marine sediments of the Coast Range exist. Agricultural pesticides, nitrates, naturally occurring selenium, and industrial organic chemicals have also contaminated some groundwater supplies in the region.

Environmental water supply. One of the major challenges facing the San Joaquin River Hydrologic Region is restoring the ecosystem along the San Joaquin River below Friant Dam while maintaining water supply reliability for other purposes. The river's historical salmon populations upstream of the Merced River were extirpated when river water was diverted after the construction of Friant Dam in the 1940s. In August 2004, a federal judge ruled that the USBR violated State Fish and Game Code 5937 by not providing enough water downstream to sustain fish populations. This litigation continues, and the resolution will be challenging because of the potential to impact water supplies for the Friant Water Users Authority. Surface water quality is also a significant concern. High salinity caused by agricultural drainage and wastewater return flows is a problem for fish in the lower San Joaquin River. Specific water quality concerns are dissolved oxygen problems in the Stockton Deep Water Ship Channel and salt and boron load limitations. There is a lot of activity and interest in the use of San Joaquin River water for environmental purposes as well as for water transfers between agriculture and municipalities, additional surface storage, conjunctive use operations, and the South Delta Improvement Program.

Tulare Lake Hydrologic Region

Water supply reliability. Uncertainty and limitations of surface water deliveries from the Delta are exacerbating groundwater overdraft because groundwater is used to replace much of the shortfall in surface water supplies. Land subsidence from long-term groundwater overdraft has caused some damage to canals, utilities, pipelines, and roads. Water transfers within these areas have and will become more common as farmers seek to minimize water supply impacts on their operations. In urban areas water conservation and water recycling programs are being accelerated to help offset short-term water reliability, and several major groundwater recharge programs store excess water during wet periods for extraction and use during dry periods.

Water quality. Much of the groundwater in the western Valley floor area is not suitable for use because of its high salinity and the presence of other toxic elements resulting from water percolation through the marine sediments on the west side. Naturally occurring arsenic is a serious concern for domestic water well supplies. Some areas of groundwater contain elevated levels of nitrates, sulfates, selenium, and boron, as well as pesticides such as dibromochloropropane (DBCP) used in agriculture, and the industrial solvents trichloroethylene (TCE) and dichloroethylene (DCE). Dairy operations can contribute salinity, nutrients, and microbes to both surface and groundwater.

Drainage. The lack of an agricultural drainage system plagues the poorly drained areas along the western side of the San Joaquin Valley, from Kern County northward into the San Joaquin River basin. The drainage water is sometimes contaminated with naturally occurring, but elevated, levels of selenium, boron, and other toxic trace elements that threaten water quality and fish and wildlife. Irrigation with high salinity imported water has exacerbated the drainage problem. In 2002, USBR supported an "in-Valley" solution to the drainage problem on the Valley's west side. Also in 2002, the Westlands Water District and the United States reached a settlement agreement regarding drainage service in the San Luis Unit, which reduced the acreage of irrigated lands and the associated drainage problems. More recently, the federal government is continuing to work with local interests to evaluate and select a long-term solution for the poor-quality drainage water.

Environmental water supply. The Tulare Lake Hydrologic Region encompasses four major watersheds of the Kings, Kaweah, Tule and Kern rivers. Each of these river systems have unique environmental water needs. There has been significant activity on both the Kings and Kern Rivers to restore flows for habitat as well as recreation. Modification to outlet structures and timing of releases on the Kings River provide cooler water temperatures to protect the resident trout populations. Gravel augmentation is also carried out to provide spawning habitat as well. The Kern County Water Agency has implemented a successful and innovative program of delivering supplies down the river through the City of Bakersfield for instream uses and then extracting the water farther downstream through the use of wells. Environmental water supplies on the Kaweah and Tule rivers are being modified due to the mitigation requirements tied to reservoir enlargement projects on both systems.

North Lahontan Hydrologic Region

Water supply reliability. Much of the northern third of the region is chronically short of water. During dry years, in areas with little or no surface storage, irrigation may be limited unless

surface water is supplemented with groundwater. In Modoc and Lassen counties drought is a way of life for agriculture, and seasonal irrigation continues as long as water is available. Some groundwater pumping capacities diminish very rapidly when used extensively during drought periods.

While the Truckee River Operating Agreement (TROA) has the potential to settle 50 years of interstate disputes over Truckee and Carson River waters, the execution and implementation of that agreement will require considerable effort in the coming years. California and the U.S. Department of Interior are preparing the final environmental impact statement/environmental impact report for evaluation of the TROA and potential impacts. The TROA cannot be signed and submitted for federal courts approval until after the final EIS/EIR is completed in 2006. Interstate water allocation issues are also being evaluated and negotiated for the Walker River basin, where the primary issue is the declining level of Walker Lake at the river's terminus in Nevada and the resulting increased salinity in the lake. To preserve the Lahontan cutthroat trout, which reside in the lake, significant increases in fresh water entering Walker Lake will be needed, which would likely impact upstream water users in both states.

Water quality. Water quality is generally excellent, but some communities face local water quality problems, such as the MTBE contamination of wells in South Lake Tahoe. The abandoned Leviathan Mine impacts local creeks in the upper Carson River watershed with acid mine drainage. Activities in the Lake Tahoe basin are subject to extensive prohibitions, BMPs, and analysis, intended to restore and preserve the Lake's water quality.

Environmental water supply. The principal consumptive uses of water for environmental uses in the region are those of State wildlife areas around Honey Lake. The Honey Lake Wildlife Area in southern Lassen County consists of the 4,271-acre Dakin Unit and the 3,569-acre Fleming Unit. The two units provide important habitat for several threatened or endangered species, including the bald eagle, sand hill crane, bank swallow, and peregrine falcon. River segments that have been designated as wild and scenic constitute a large part of the environmental water use within the region. Lake Tahoe is subject to extensive analysis and restoration activities to restore and preserve its water quality.

South Lahontan Hydrologic Region

Water supply reliability. Many urban areas in the developing southwestern portion of this region are now experiencing shortfalls in water supplies. Meeting water demands for projected growth and development is a concern for many water agencies. A study by the Antelope Valley Water Group concluded that the valley's existing and future water supply reliability from groundwater, the SWP, Littlerock Reservoir, and recycling is low and that current water demands could be met only half the time without overdrafting groundwater resources. The Mojave River groundwater basin adjudication was finalized in 1996 as a mechanism to permanently control groundwater usage and overdraft in that region.

Water quality. Like the North Lahontan region, water quality is generally excellent, though there are local impairments. When drinking water standards are exceeded in public water supply wells, it is most often for TDS, fluoride, or boron. Water quality and quantity are inherently related in the Owens River watershed due to the large exports of surface water and groundwater by the City of Los Angeles. Arsenic is a health concern in the Owens River basin, and therefore, in the water exported to Los Angeles as well.

Environmental water supply. Ecosystem protection and restoration efforts are continuing to raise the level of Mono Lake and restore the migratory bird habitat of the South Lahontan Hydrologic Region. In the Owens River basin, plans are under way to restore surface flows to a 60-mile stretch of the lower river that was dewatered after the Los Angeles Aqueduct was completed in 1913. This ambitious restoration project will return live flows to the riverbed on a year-round basis, rebuild the riparian habitat, and reintroduce fish and other native wildlife. At the lower end of this 60-mile stretch, the remaining water would be recaptured and returned to the Los Angeles Aqueduct.

Colorado River Hydrologic Region

Water supply reliability. One of the most significant challenges of this region will be adapting to requirements of the new Quantification Settlement Agreement (QSA) for distribution and use of California's legal entitlement of Colorado River water. Under this 2003 agreement California agencies must reduce total consumptive use of Colorado River water to 4.4 million acre-feet per year; whereas, past usage often exceeded 5.0 maf/year. The QSA also assists the transfer of water to meet urban needs in the South Coast region and provides water for Salton Sea. Other regional issues include the potential impacts of Colorado River fish restoration programs on the availability of water for diversions and the development of solutions to groundwater overdraft problems in the upper (urbanized) and lower (agricultural) part of the Coachella Valley.

Water quality. The Colorado River provides irrigation and domestic water to much of Southern California. The water's salinity (generally between 600 to 700 parts per million) is a concern for salt-sensitive crops. Municipal water agencies blend this supply with low salinity water supplies, including groundwater (except in the Imperial Valley, which lies above a saline aquifer). Low levels of perchlorate in the Colorado River (originating from the Las Vegas Wash area) and high levels of hexavalent chromium in wells near the river at Needles, are recent concerns for drinking water quality. Aging septic systems at recreational areas along the Colorado River are also a cause of water quality concern for both domestic and recreational water uses.

Ecosystem restoration. Salton Sea is the focus of international water quality and ecosystem restoration efforts in Southern California. An important stop along the Pacific Flyway, the saline and eutrophic sea supports a productive fishery and more that 400 species of resident and migratory birds, of which more than 50 have status as threatened, endangered, or species of concern. The largest sources of the sea's inflow are (1) the New River, which originates in, and conveys industrial and agricultural wastes from Mexico into the United States; (2) the Alamo River, which also originates south of the border and consists mainly of agricultural return flows from the Imperial Valley; and (3) the Imperial Valley agriculture drains, which transmit pesticides, nutrients, selenium, and silt to the sea. Nutrient input to the sea can contribute to algal blooms and odors, and lead to low dissolved oxygen conditions that are dangerous to fisheries. If a solution is not developed and implemented soon, Salton Sea is likely to become too saline to support many of the current fish and the bird populations.

Sacramento-San Joaquin Delta

Water supply reliability. Because local Delta water users draw from adjacent channels, they normally have immediate access to water. But Delta water quality and channel water levels can be influenced by pumping plant operations of the SWP and CVP, especially in the vicinity of south Delta islands. Lower water levels in the south Delta in combination with low river inflows from the San Joaquin River can make it difficult for local irrigation diversions to access the water. State and federal agencies are coordinating efforts to design and launch the South Delta Improvements Program, which proposes construction of gates to improve water levels and flows.

The maintenance and operational flexibility of SWP and CVP export pumping plants is critical toward meeting present and future water needs, especially for those who depend on the projects for delivery of water supply, which includes most of the San Joaquin Valley, Southern California, and portions of the San Francisco Bay Area. Periodic pumping limitations due to water quality and salinity issues and because of environmental restrictions for endangered fish (salmon and delta smelt) pose significant operational challenges. Among the proposals under study are improvements to pumping capabilities and the coordinated use of the SWP and CVP to create more flexibility in meeting export needs without causing adverse impacts to the Delta environment and water quality.

Water quality. The Delta is a major water source for portions of the San Francisco Bay Area, the San Joaquin Valley, and Southern California. Salinity (from saltwater intrusion and from agricultural drainage), organic carbon, and pathogens are among the major constituents of concern for water agencies that divert water for domestic purposes. Water quality threats include population growth and increased wastewater discharge and urban runoff in Delta tributaries, recreational use within Delta waterways, and agricultural runoff and drainage from the Central Valley. Environmental water quality concerns also include mercury, organophosphate pesticides, selenium, and toxicity throughout the Delta, as well as low dissolved oxygen in the lower San Joaquin River.

Levee stability. The historical construction of levees on unstable peat soils has made Delta levees vulnerable to failure, especially during earthquakes or floods. Levee failures cause substantial flooding and damage to the agricultural lands on Delta islands (such as the Jones Tract levee break in early June 2004), and also can adversely impact Delta water quality. Long-term programs are being developed by DWR, in cooperation with CBDA, to address levee stability problems and to develop solutions and funding resources to strengthen levees and protect the Delta's water quality.

Environmental water supply. Over the past century, the health of the Delta ecosystem has declined with the destruction of habitat for both aquatic and terrestrial biota. Habitat quality has also declined due to diversion of water, toxics, exotic species, and other factors. Conversion of agricultural land to other uses to accommodate ecosystem improvements and other environmental restoration programs are being developed by the CALFED Bay-Delta Program as part of the long-term efforts to restore the Delta environment. The CALFED Ecosystem Restoration Program is funding several projects to monitor and identify the source of specific episodes of toxicity in the Delta. As part of the ERP projects, studies are being conducted on splittail and delta smelt exposure to unknown toxics.

Mountain Counties

Water supply reliability. The rapid urban growth and associated increases in water usage in the western foothill portion of this region is stressing available water supplies for many local districts and agencies. New surface water supplies are difficult to obtain because most of the available rights were previously appropriated and are now assigned to downstream users in the Sacramento and San Joaquin valleys and the coastal regions. More than 75 percent of the available surface water is stored and exported to water service areas outside of the region. Groundwater supplies in this region are also very limited because the underground geology consists of mostly fractured rock formations with very few significant aquifers. The lack of available new water supplies and the high cost of developing new water are posing major development problems for the growing communities in the region. Water agencies will need to consider a wide array of water management strategies to meet future needs, including increased water recycling, conservation, reclamation, conjunctive use programs, water exchanges, and water purchases. Some local agencies may test the State's "Area of Origin and Watershed Protection" laws as a mechanism for obtaining a larger share of the available water supply.

Water quality. Domestic water users generally benefit from high quality water supplies, but in some of the smaller rural delivery systems water quality can be degraded because of open reservoirs and delivery canals and inadequate water disinfection facilities. In some watersheds, drainage from abandoned mines contributes metals and other toxic elements to rivers that create water quality problems in downstream water bodies. Erosion from natural flooding, logging, land development, and areas devastated from forest fires, causes increased stream sedimentation to downstream areas as well.

As a result of the rapidly increasing population growth, the capacities of wastewater treatment systems for many water agencies is being stressed or exceeded, in some areas, resulting in wastewater treatment plant overflows to rivers and streams. The widespread use of septic tank systems is also problematic in relation to groundwater quality. Rural water agencies often have limited financial resources that restrict the ability to plan and construct wastewater system expansions to keep pace with the rate of urban growth.

Responses

Today's water management considers a broad range of resource management issues, competing water demands, and diverse water management tools. In recent decades, water management methods like storage and conveyance have been adapted to include more water conservation and recycling and other water management strategies. Moreover, regional and local agencies play an increasingly significant role in water planning. Regional initiatives that are under way are described in Volume 3 Regional Reports.

Moving Toward Regional Water Reliability

Water managers have learned that even though imported supplies will continue to be important, they cannot be relied on to satisfy growing water demands. In the 1980s concerns for protecting the environment were manifested in strong new laws and regulations. These regulations affected the ability of imported water projects to deliver water. The resulting uncertainty also contributed to hesitancy to invest in additional facilities for these interbasin systems and forced water agencies to face difficult decisions about how to provide a reliable water supply.

Local and regional agencies are looking more intensely at local water management options such as water conservation and recycling measures and groundwater storage. Water managers are learning that planning for sustainable water use must address multiple resource objectives—water use efficiency, water quality protection, and environmental stewardship—and consider broad needs—economic growth, environmental quality, and social equity.

Throughout California, stakeholders have begun working together to develop regional and watershed programs that cover multiple jurisdictions and provide multiple resource benefits. In several regions, agencies formed partnerships to combine capabilities and share costs. Integrated regional water management has taken a foothold and is on the rise. (See Box 3-6 Examples of Ongoing Regional Water Planning Efforts.)

Integrated Regional Water Management

California is placing more emphasis on integrated regional water management because it

- makes better use of existing local resources,
- provides for coordination and improved efficiency and flexibility in the actions of local agencies and governments within a region,
- integrates all aspects of water management, including water quality, local surface water, groundwater, conservation, recycled water, conveyance, ecosystem restoration, and imported supplies.
- reflects regional diversity and values when setting management objectives.

Box 3-6 Examples of Ongoing Regional Water Planning Efforts

One of the ways in which broad public benefits can be achieved is through the establishment of partnerships that combine the capabilities of individual agencies to create opportunities that would not otherwise be possible. Following are some examples. Those listed with an asterisk (*) are given more detail below.

- Klamath River Watershed Framework
- Sacramento Valley Water Management Program and Basin Wide Management Plan*
- Regional Water Authority*
- [Sacramento] Water Forum*
- Freeport Regional Water Project
- Bay Area Water Forum
- San Joaquin River Agreement
- Mokelumne River Basin Collaborative Planning Process
- Westside San Joaquin Valley Integrated Resource Planning Program
- San Joaquin Valley Water Coalition
- Kern County Water Agency Conjunctive Management Program
- Upper Kings River Basin Water Forum
- Metropolitan Water District of Southern California Integrated Resources Planning Program*
- Santa Ana River Watershed Program*
- Colorado River Quantification Settlement Agreement (QSA)

Sacramento Valley Water Management Program

The purpose of the Sacramento Valley Water Management Program is to promote better water management in the Sacramento Valley and develop additional water supplies through a cooperative water management partnership. The SVWM Program was developed to help resolve water quality and water rights issues arising from the need to meet the flow-related water quality objectives of the 1995 Bay-Delta Water Quality Control Plan and the State Water Resources Control Board's Phase 8 Water Rights Hearing process. The participants include the U.S. Bureau of Reclamation, the California Department of Water Resources, Northern California Water Association, and various Sacramento Valley and export water users.

To implement the program, Northern California water districts and companies have proposed more than 50 projects that will be part of both short- and long-term work plans being developed by a team of leading hydrologists and engineers. These projects will protect Northern California water rights and include groundwater planning and monitoring projects, providing for unmet demands in the Sacramento Valley, system improvement and water use efficiency measures, conjunctive management and surface water re-operation projects.

Groundwater protection is central to the work plan. Local water users have proposed these work plan projects, which will be managed and controlled by local interests. Additionally, the parties are preparing a program environmental review and will jointly seek public funds, including Proposition 50, to help implement many of these projects.

Regional Water Authority

The Regional Water Authority (RWA), inaugurated in June 2001, serves as a joint powers authority for 18 member agencies and 3 associate agencies in the greater Sacramento, Placer, and El Dorado County region. RWA works to protect and improve the reliability, availability, affordability, and quality of water resources in the region, and was formed through the consolidation of several regional associations after two years of workshops with dozens of water interests.

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Box 3-6 continued from previous page

To meet the needs of the more than a million people within the region, RWA has created several new initiatives, including a water efficiency program for local purveyors and the $43 million American River Basin Regional Conjunctive Use Program, which has been assisted by a $22 million grant from the Department of Water Resources through RWA funding efforts. RWA has also been a key player in the Sacramento Area Water Forum discussions over the American River and has organized workshops and classes to provide educational and technical assistance to local organizations and individuals.

RWA has been widely identified as a good example of using regional partnerships to coordinate water management efforts and to secure funding for water projects. Around $19 million has been awarded to RWA in the form of grants to support its innovative water efficiency program. The authority has developed good working relations with State and local agencies throughout the region.

[Sacramento] Water Forum

In the American River watershed, individual groups, water suppliers, environmentalists, local governments, business groups, agriculturalists, and citizen groups were all independently pursuing their own water objectives with little or no success. For more than 20 years, the various stakeholders were locked in a litigious battle over the American River. Even though millions of dollars had been spent pursuing single purpose solutions, there was little to show for these fragmented efforts.

In 1993, the City of Sacramento and the County of Sacramento came up with a possible solution to these water wars – the Water Forum. Bringing together a diverse group of business, agricultural leaders, citizens groups, environmentalists, water managers and local governments; the Water Forum was created. It was a six-year crusade of intense interest-based negotiations which required each stakeholder to put aside their demands ("positions") and instead focus on the underlying reasons ("interests") behind both their own and their adversaries' concerns. This creative approach resulted in the Water Forum Agreement.

Signed by each of the stakeholder organizations in April 2000, the Water Forum Agreement is a comprehensive document that allows the region to meet its needs in a balanced way through implementation of seven elements. These elements include detailed understandings among stakeholder organizations on how this region will deal with key issues to the year 2030. The seven elements are:

1. Increased surface water diversions
2. Actions to meet customers' needs while reducing diversion impacts on the lower American River in drier years
3. An improved pattern of fishery flow releases from Folsom Reservoir
4. Lower American River Habitat Management Element
5. Water Conservation Element
6. Groundwater Management Element
7. Water Forum Successor Effort

To ensure implementation of the Water Forum Agreement, the seventh element, the Successor Effort was created to oversee, monitor and report on implementation of the Agreement. The signatories to the Water Forum Agreement committed their organizations to continued participation in the partnership. Since the signing, there has been significant progress toward implementing many of its projects.

The Water Forum Agreement acknowledges that there is no single-purpose program that will secure our water future; therefore, it is necessary to implement a full range of complementary actions through 2030 that will achieve the Water Forum's two co-equal objectives: Provide a reliable and safe water supply for the region's economic health and planned development to the year 2030; and preserve the fishery, wildlife, recreational, and aesthetic values of the lower American River.

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Box 3-6 continued from previous page

Metropolitan Water District Integrated Water Resources Plan

The Metropolitan Water District of Southern California (MWD) is a large consortium of 26 cities and water districts that provides an average of 1.7 billion gallons per day of drinking water to almost 18 million customers. Because of its important role in distributing water in California and maintaining adequate quantity and quality of supplies for its members, MWD developed its integrated water resources plan in 1996. It identified a "Preferred Resource Mix" that includes recommendations for meeting full service retail demands through 2020.

In 2001 the MWD Board of Directors initiated an effort to update the 1996 plan to review past goals and achievements, determine what conditions related to water resource development had changed since 1996, and to update the targets contained in the "Preferred Resource Mix" through 2025. The 2003 Metropolitan Water District Integrated Water Resources Plan, which was approved July 2004, was developed with the assistance of the MWD Board, a plan workgroup, MWD member agencies, environmental organizations, agricultural representatives, and other parties, and included several changes from the earlier plan. Higher conservation savings are stressed in the 2003 plan, along with increased use of desalination, recycling, and groundwater recovery, to meet 100 percent reliability needs through 2025. The 2003 MWD plan is a useful example of using integrated resource planning in conjunction with regional partnerships to develop goals and objectives for comprehensive water resource management.

According to Chief Executive Officer Ronald R. Gastelum, Metropolitan's preparations and ability to deal with water shortages, drought and emergencies have expanded in recent years. "The great strides that Metropolitan and its member public agencies have made in water storage, conservation, recycling, transfer and option programs have helped the region through recent periods that otherwise could have been called droughts and have prepared us well for future droughts and emergencies. We anticipate working with all of our member agencies to further strengthen our resources management in both wet times and dry," Gastelum stated in a March 2005 press release issued in response to a State Appellate Court upholding MWD's water allocation formula.

New partnerships should be explored in other parts of the state to determine other opportunities to collaborate and pool resources for more effective, regional water management. As shown in these examples, partnerships can provide broad public benefits that otherwise would not be possible through actions of the individual agencies. By employing the principles of integrated resource planning, these partnerships can develop well-structured objectives and holistic strategies to meet objectives while responsibly managing California's precious water resources.

Santa Ana Watershed Project Authority

Formed as a planning agency in 1968, the Santa Ana Watershed Project Authority (SAWPA) was later reorganized and in 1975 officially became a joint powers authority (classified as a Special District under California law). SAWPA has five member agencies: Eastern Municipal Water District (EMWD), Inland Empire Utilities Agency (IEUA), Orange County Water District (OCWD), San Bernardino Valley Municipal Water District (SBVMWD), and Western Municipal Water District (WMWD). The agencies span almost 2,000 square miles and include more than 4 million people.

The purpose of creating SAWPA was to better implement projects focused on several key objectives: water quality control; pollution abatement using waste treatment management plans for the watershed area; disposal of wastewater, storm water, and other wastes; irrigation, municipal, and industrial water supply development; aquifer rehabilitation; and water reclamation, recycling, and desalting. SAWPA has authority to issue bonds and take on other forms of indebtedness to fund projects, and has additional powers granted to joint power authorities.

continued

Integrated regional water management is a comprehensive, systems approach for determining the appropriate mix of demand and supply management options that provide long-term, reliable water supply at lowest reasonable cost and with highest possible benefits to customers, economic development, environmental quality, and other social objectives. (See Chapter 2 Framework for Action for a full discussion of integrated regional water management.)

Water agencies in many regions are successfully employing a mix of resource management strategies with State and federal incentives. Experience is showing that these regional efforts can better resolve regional needs, especially when paired with statewide water management systems. Regional water management options can reduce physical and economic risks and provide regional control over water supplies. More is being done to meet water demands with water conservation, reoperation of facilities, water recycling, groundwater storage and management, transfer programs, and, in limited cases, regional or local surface storage reservoirs. (See Volume 2 Resource Management Strategies for further discussion of regional management options.) Overall, this increased focus on integrated regional water management solves water management problems more efficiently, considers other resource issues, and enjoys broader public support.

With integrated regional water management, regions have been able to take advantage of opportunities that are not always available to individual water suppliers: reduce dependence on imported water and make better use of local supplies; enhance use of groundwater with greater ability to limit groundwater overdraft; increase supply reliability; security; and improve water quality. The extent to which regions have carried these out has been driven by considerations like economics, environment, engineering, and institutional feasibility. (See Box 3-7 Complementary Management Approaches: IRWM and Watershed Management)

Integrated regional water management results in plans that address multiple water and related resources objectives to produce multiple benefits. As an example, in some areas of the state where it is feasible, agricultural users are developing water use efficiency projects that simultaneously help stretch limited water supplies, reduce loads of contaminants, preserve the agricultural economy, and improve aquatic habitat. Similarly, some urban areas are looking at multipurpose projects that use storm water for groundwater recharge thereby increasing water supply, reducing urban runoff, improving water quality, and decreasing costs for drainage facilities. Although they may not yet be making significant contributions to urban water supply reliability, these types of projects produce a diverse and valuable mix of other benefits.

The California Legislature has enacted several regulations to improve integrated regional water management (see Box 3-8 New Laws Support Integrated Regional Water Management). Recent legislation has also encouraged improvements in recycling, desalination, and groundwater management. These statutory changes provide incentives for pursuing integrated regional water management and reflect the goals of managing water supplies with more flexibility while addressing an array of benefits and interests. For example, Water Code section 10530 et seq. (SB 1672 Stats. 2002, ch. 767 and AB 2469 Stats. 2002, ch. 949) provide for Integrated Regional Water Management plans and specify that a planning group developing these plans be composed of at least 3 local agencies, 2 of which must have statutory authority over water supply. The emphasis in this part of the Water Code is on integrating local water management to create greater flexibility and diversity in managing water demands and supplies while potentially addressing other water issues such as flood management, wastewater treatment, and ecosystem health.

Water managers are learning that planning for sustainable water use must address multiple resource objectives—water use efficiency, water quality protection, and environmental stewardship—and consider broad needs—economic growth, environmental quality, and social equity.

Box 3-6 continued from previous page

Because the Santa Ana watershed is one of the fastest-growing regions in California and because of the high regional demand for good-quality water supplies, SAWPA has faced severe challenges since its creation. By forming a regional partnership, SAWPA has been able to obtain funds that might otherwise be inaccessible or overly expensive, and the authority has been able to speak with a common voice for its members before the Legislature and in other policy and management forums.

Coordination of Water and Land Use Planning

Three bills enacted by the Legislature to improve the coordination between water supply and land use planning processes at the local level became effective January 1, 2002 (see Box 3-9 SB 221, SB 610, and AB 901). In general, the new laws are intended to improve the assessment of water supplies during the local planning process before approval of land use projects that depend on water. The new laws require verification of sufficient water supplies as a condition for approving developments, and they compel urban water suppliers to provide more information on groundwater reliability if used as a supply. They also require average and drought year conditions be addressed when evaluating water supply reliability.

The State of California General Plan Guidelines, updated in 2003 (OPR), recommends that local government include an optional water element in their general plans. Several jurisdictions have developed, or are now preparing, water management elements and chapters for their general plans.

AB 857 (Stats. 2002; ch. 1016) establishes three planning priorities and requires that all State strategic plans and capital improvement plans—including the next update of the Governor's Environmental Goals and Policy Report and the California Water Plan—be consistent with them. The Governor and Legislature set the following planning priorities to promote equity, strengthen the economy, protect the environment, and promote public health and safety in California. The overarching purpose is to establish a tie in State policy between planning, social equity, and the human environment.

- Promote infill development and equity,
- Protect environmental and agricultural resources, and
- Encourage efficient development patterns.

Increased focus on integrated regional water management solves water management problems more efficiently, considers other resource issues, and enjoys broader public support.

Statewide and Interregional Response

We have learned that solutions to California's water management issues are best planned and carried out on a regional basis. However, the State has led collaborative efforts to find solutions to water issues having broad public benefits such as protecting and restoring the Delta, Salton Sea, Lake Tahoe, and Mono Lake. Statewide and interregional responses to water resource emergencies and management needs are summarized in this section, including programs, task forces, reports, water bonds, legislation, and federal programs. (See Box 3-10 Recent Statewide and Interregional Responses to Challenges.)

Programs and Planning

CALFED Bay-Delta Program's Record of Decision Stage 1 Actions. In August 2000, the CALFED Bay-Delta Program issued a Programmatic Record of Decision (ROD) that set forth a 30-year plan to address ecosystem health and water supply reliability problems in the Bay-Delta. The Program plan addresses four interrelated, interdependent resource management objectives concurrently: water supply reliability, water quality, ecosystem restoration, and levee system integrity. (See Box 2-5 CALFED Bay-Delta Program.) The program's mission is to:

- Provide good water quality for all beneficial uses.
- Improve and increase aquatic and terrestrial habitats and improve ecological functions in the Bay-Delta to support sustainable populations of diverse and valuable plant and animal species.

Box 3-7 Complementary Management Approaches: IRWM and Watershed Management

Many overlapping characteristics and issues confront integrated regional water management and watershed management. Both approaches are being used in California to combine local, State, and federal resources to create a broader, more flexible water management system. Watershed management is a process of evaluating, planning, managing, and organizing land and other resource use within a watershed while maintaining a sustainable ecosystem. For regional planning purposes in California, a watershed includes living (including the people who live and work in the watershed) and nonliving elements within a defined geographical area that is generally characterized by the flow of water. Watershed management seeks to balance changes in community needs with evolving ecological conditions. (See Volume 2 for more discussion of watershed management as a resource management strategy.)

- Reduce the mismatch between Bay-Delta water supplies and current and projected beneficial uses dependent on the Bay-Delta system.
- Reduce the risk to land use and associated economic activities, water supply, infrastructure, and the ecosystem from catastrophic breaching of Delta levees.

The CALFED Bay-Delta Program began Stage 1 implementation after signing of the ROD. (Stage 1 covers the first seven years of program implementation.) Actions taken during Stage 1 build the foundation for future, long-term actions specified in the Program's Programmatic Environmental Impact Statement/Report. Through 2003 CALFED had invested nearly $2 billion in water supply, water quality, and ecosystem restoration programs; significantly reduced conflicts over Delta operations through better agency coordination and the new Environmental Water Account; and launched an independent science program, which brings national experts together to conduct workshops and reviews of all major program activities. The California legislature established the CBDA as a new governance structure to oversee the Program and the CALFED agencies.

Consistent with the commitment in the Governor's budget 2005-06, a three-point plan was developed that will allow the CALFED Program to move forward and focus on addressing the highest priority issues associated with conflicts in the Delta.

Colorado River Agreement. In legislation enacted in 2003 to start the Colorado River QSA, the State of California accepted significant responsibilities and liabilities for mitigation of the agreement's environmental impacts and for Salton Sea ecosystem restoration. The State's actions were to enable the QSA's local agency signatories to reach agreement on how to reduce their use of Colorado River water to California's basic interstate apportionment of 4.4 million acre-feet annually. The QSA implementing legislation is contained in three bills chaptered in 2003—SB 277, SB 317, and SB 654.

Included in the QSA are water transfers—from Imperial Irrigation District to San Diego County Water Authority and to Coachella Valley Water District—that will reduce the inflows of agricultural runoff that constitute Salton Sea's chief source of fresh water. The sea's present salinity of about 48,000 milligrams per liter (mg/l) is about 30 percent higher than ocean water. As the sea's salinity increases through evaporation and concentration of salts, it will become too saline to support its present fish and wildlife resources.

Global Climate Change. On June 1, 2005, Governor Schwarzenegger signed Executive Order S-3-05. The Executive Order, in part, states:

- California is particularly vulnerable to the impacts of climate change;

Box 3-8 New Laws Support Integrated Regional Water Management

SB 672 (Stats. 2001, ch. 320) and SB 1341 (Stats 2000, ch. 720). Increased the focus on regional and integrated water planning in preparing the California Water Plan Update.

The Integrated Regional Water Management Planning Act of 2002 (Stats. 2002, ch. 767). Authorizes regional water management groups to prepare and adopt regional plans and requires the Department of Water Resources and other State agencies to include the status of regional water management planning in the set of criteria used to select projects for grant and loan programs.

SB 1938 (Stats. 2002, ch. 603). Requires agencies seeking funding for groundwater projects to include a plan for coordinating with other agencies within a region.

California Bay-Delta Authority. The governor and Legislature encouraged the regional approach by including regional representatives on the new California Bay-Delta Authority to oversee the Bay-Delta Program.

Proposition 50, "Water Security, Clean Drinking Water, Coastal and Beach Protection Act of 2002." The voters of California provided further support for regional solutions with approval of this proposition, which includes $500 million for Integrated Regional Water Management.

SB 221 (Stats. 2001, ch. 642) and SB 610 (Stats. 2001, ch. 643). Require greater coordination and more extensive data to be shared between water suppliers and local land use agencies for large development projects and plans.

These and other legislation passed since Bulletin 160-98 are described in Volume 4 Reference Guide article "Recent Water Legislation."

- Climate change threatens the State's water supply, as well as other resources;
- California must take efforts to reduce greenhouse gas emissions; and,
- the State must prepare for the consequences of global climate change.

The Executive Order:

- establishes greenhouse gas emission reduction targets;
- directs the Secretary of the California Environmental Protection Agency to coordinate with other State agencies to meet the reduction targets;
- directs that biannual reports be submitted to the Governor and the Legislature to report on progress made toward meeting the targets; and,
- directs that biannual reports be submitted to report on the impacts of global climate change on California and to report on mitigation and adaption plans.

The first biannual reports required by Executive Order S-3-05 are due January 2006.

Hetch Hetchy Valley. The Resources Agency directed DWR and the Department of Parks and Recreation to review and summarize studies and analyses prepared over the last 20 years on the feasibility of restoring Hetch Hetchy Valley. DWR and State Parks are reviewing existing reports, along with applicable local, State, and federal resource plans, and will provide an evaluation of pertinent water supply, water quality, flood management, recreation, environmental, economic, and energy issues. The review includes evaluation of options and likely costs of replacing water and energy supplies, increased water treatment, removal of O'Shaughnessy Dam, and recreational opportunities in and restoration of Hetch Hetchy Valley. No new analytical studies are being conducted as part of this project. The final report, scheduled for release by the end of 2005, will also identify the necessary next steps for a more comprehensive study. The State is working with and obtaining information from the San Francisco Public Utilities Commission and its retailers, American Indian tribes, the National Park Service, those affected downstream of Hetch Hetchy, and environmental interest groups.

Box 3-9 SB 221, SB 610, and AB 901

SB 221 (Bus. and Prof. Code, § 11010 as amended; Gov. Code, § 65867.5 as amended; Gov. Code, §§ 66455.3 and 66473.7) prohibits approval of subdivisions consisting of more than 500 dwelling units unless there is verification of sufficient water supplies for the project from the applicable water supplier(s). This requirement also applies to increases of 10 percent or more of service connections for public water systems with less than 500 service connections. The law defines criteria for determining "sufficient water supply, such as using normal, single-dry, and multiple-dry year hydrology and identifying the amount of water that the supplier can reasonably rely on to meet existing and future planned uses. Rights to extract additional groundwater must be substantiated if used for the project.

SB 610 (Water Code, §§ 10631, 10656, 10910, 10911, 10912, and 10915 as amended; Pub. Resources Code, § 21151.9 as amended) and AB 901 (Water Code, §§10610.2 and 10631 as amended; Water Code § 10634) make changes to the Urban Water Management Planning Act to require additional information in Urban Water Management Plans (UWMPs) if groundwater is identified as a source available to the supplier. Required information includes a copy of any groundwater management plan adopted by the supplier, proof that the developer or agency has rights to the groundwater, a copy of the adjudication order or decree for adjudicated basins, and if not adjudicated, whether the basin has been identified as being overdrafted or projected to be overdrafted in the most current California Department of Water Resources publication on the basin. If the basin is in overdraft, the UWMP must include current efforts to eliminate any long-term overdraft. A key provision in SB 610 requires that any project that is subject to the California Environmental Quality Act and supplied with water from a public water system be provided a water supply assessment, except as specified in the law.

State of California General Plan Guidelines (OPR 2003) recommends facilitating SB 610 by having strong water elements in local general plans that incorporate coordination between the land use agency and the water supply agency. AB 901 requires the plan to include information relating to the quality of existing sources of water available to an urban water supplier over given periods and include the manner in which water quality affects water management strategies and supply reliability.

Box 3-10 Recent Statewide and Interregional Responses to Challenges

Programs and Planning

- CALFED Bay-Delta Program's Record of Decision (2000)
- California's Colorado River Quantification Settlement Agreement (2003)
- Lower Owens River Project (2003)
- Sacramento and San Joaquin River Basins Comprehensive Study
- San Joaquin River Agreement
- San Joaquin River Management Program
- Trinity River Basin (2000)
- Truckee River Basin (since 1991)

Regional Initiatives

- See Volume 3 for regional initiatives that are under way

Task Forces and Advisory Panels

- California Commission on Building for the 21st Century
- California Floodplain Management Task Force Recommendations
- California Watershed Council
- Desalination Task Force
- Governor's Advisory Drought Planning Panel's Critical Water Shortage Contingency Plan
- Landscape Task Force (AB 2717)
- State Recycling Task Force
- State Watershed Management Guidelines Initiative (formed Joint Task Force on California Watershed Management)

State Bulletins and Reports

- California's Groundwater Update 2003 (Bulletin 118)
- Fish Passage Improvement (Bulletin 250-2003)
- General Plan Guidelines Update 2003 (recommends new Water Element)
- Management of the California State Water Project (annual publication of Bulletin 132)

Water Bonds

- Proposition 204, November 1996, $995 million
- Proposition 13, March 2000, $1.97 billion
- Proposition 40, March 2002, $2.6 billion
- Proposition 50, November 2002, $3.4 billion

Water Legislation

- See Volume 4 article "Recent Water Legislation"

Water Litigation

- See Volume 4 articles "Joint Statement on the Monterey Amendments Litigation" and "Summary of Significant Litigation 1998-2005"

Klamath Basin. Since the drought of 2001, some Klamath Basin farmers have switched to groundwater as a source of water supply for their crops, which has been encouraged by USBR financial support. Oregon has issued more than 130 new permits for well construction in the Klamath Basin, yet very little is known about the capacity and recharge capability of this underground supply source. In 2004 it was reported that groundwater levels are declining—in some areas by as much as 20 feet. This has raised new concerns about the adequacy of the groundwater basin, and Oregon is now working with the U.S. Geological Survey (USGS) and the State of California to evaluate and report on the capabilities of this interstate groundwater system.

In March 2002 the federal administration established a cabinet-level Klamath River Basin Federal Working Group that includes the departments of Interior, Agriculture, and Commerce to address concerns raised by farmers, ranchers, anglers, tribes, and others affected by the difficult conditions in Klamath. As part of the working group, the Department of Agriculture is helping farmers and ranchers start a variety of conservation programs. For example, the Natural Resources Conservation Service is working with a number of landowners to improve wetland and wildlife habitat through the Wetlands Reserve Program. This includes an additional 2,500 acres enrolled in permanent easements during 2002. The projects are on Upper Klamath Lake and the Williamson River, both major water sources of the Klamath Basin. These projects will benefit water quality and improve wildlife habitat, thereby providing benefits to the endangered Lost River sucker and shortnose sucker fish (USDA 2004).

Mono Lake and Owens River. In the Mono Lake and Owens River basins, extensive long-term water diversions through the Los Angeles Aqueduct to Southern California have negatively affected the region for decades. In 1993 after years of litigation the Los Angeles Department of Water and Power (LADWP) began final flow releases to restore Mono Lake to previous levels, with a desired water surface elevation of 6,392 feet. Under this restoration program, Mono Lake's surface elevation has been rising and reached an elevation of 6,382 feet by year 2003.

In December of 2003 the LADWP and the City of Los Angeles approved a tentative agreement with several Owens Valley interest groups called the Lower Owens River Project (LORP) that will return water to a 62-mile stretch of the lower Owens River to restore the riparian ecosystem. After modifications to existing diversion structures are completed, this program is expected to start operations in the fall of 2005 with a base flow of 40 cubic feet per second. If successful, LORP has the potential to become one of the most significant river restoration projects undertaken in the United States.

Sacramento and San Joaquin River Basins Comprehensive Study. State and federal legislation authorized the development of comprehensive plans for flood damage reduction and ecosystem restoration along the Sacramento and San Joaquin rivers following the disastrous floods that occurred in January 1997. Although there is widespread agreement that changes are needed to improve the system, there is no agreement at this time where the various measures should take place. What did evolve from these planning efforts is a process to develop future projects to meet the system's comprehensive public safety, flood damage reduction, and ecosystem restoration objectives. This process consists of guiding principles for integrating flood damage reduction and ecosystem restoration in future changes to the flood management system. The process provides an approach to develop projects that ensures system-wide effects are evaluated regardless of project scale and an administrative structure to oversee consistent application of the process.

The December 2002 interim report (USACE) recognizes the water supply conveyance benefits of the levee system and suggests that a broader responsibility for maintenance of the flood management system should be considered. The Reclamation Board of the State of California endorsed the interim report on December 20, 2002.

As a result of the comprehensive study, a draft feasibility study/EIS/EIR has been prepared for the Hamilton City Flood Damage Reduction and Ecosystem Restoration Project about 85 miles north of Sacramento on the Sacramento River. This study proposes replacing the existing "J" levee with a new setback levee that will protect the Hamilton City community of about 2,000 people plus surrounding agricultural lands while restoring about 1,500 acres of native vegetation along the Sacramento River.

San Joaquin River Basin. AB 3603 (1990) authorized the San Joaquin River Management Program (SJRMP) to provide a regional forum for identification, discussion, and development of projects and programs intended to improve the river's water quality, fisheries, water supply, flood control, and recreation. In 1995 the completed SJRMP Plan identified approximately 80 consensus-based projects and studies that could be undertaken to improve the river system. Although some projects and programs have been successfully started, many others are on hold until sufficient funding and sponsors can be obtained.

The San Joaquin River Agreement was approved in 1999 to support and implement the Vernalis Adaptive Management Plan, which establishes procedures to meet the river's provisions of the SWRCB's 1995 Water Quality Control Plan. VAMP is a 10-year test program that evaluates the capability of April-May pulse flows in the lower San Joaquin River to improve the survival of salmon smolt migrating to San Francisco Bay. The agreement facilitates the funding and purchase of water from upstream reservoirs, which is released per VAMP pulse flow criteria in April and May.

Trinity River Basin. The Secretary of the Interior in December 2000 approved significant change in use of Trinity River basin water. As part of an effort to restore Trinity River fish habitat, the river's instream flows were increased from 340,000 acre-feet per year (roughly 25 percent of average annual flow at the CVP diversion point on the Trinity River) to an average of 595,000 acre-feet per year. This decision, which would reduce the amount of water available for export from the Trinity River to the Central Valley, was challenged by water and power interests in U.S. District Court in 2001. On July 13, 2004, the 9th U.S. Circuit Court of Appeals overturned the injunction and ruled that the original year 2000 Record of Decision was adequate. The water allocated to downstream fish flows is now being increased to the new flow schedule, which ranges from a minimum of 368,600 acre-feet in a critically dry year up to 815,000 acre-feet in an extremely wet year.

Truckee River Basin. In the interstate Truckee River Basin, which includes Lake Tahoe, efforts continue to resolve years of disputes over the waters of the Truckee and Carson rivers. In 1990 Congress passed the Truckee-Carson-Pyramid Lake Water Rights Settlement Act (Public Law 101-618), which makes an interstate allocation of the waters between California and Nevada, provides for the settlement of certain American Indian rights claims, and provides for water supplies for specified environmental purposes in Nevada. California's water entitlements under this act will be established as 23,000 acre-feet annually in the Lake Tahoe Basin and 32,000 acre-feet annually in the Truckee River Basin below Lake Tahoe with the remainder of the basin water supply assigned to water interests in Nevada. However, provisions of the Settlement Act, including the interstate water allocation, will not take effect until several conditions are met, which include negotiation and approval of a new Truckee River Operation Agreement (TROA).

Negotiation of a proposed TROA and preparation of its EIS/EIR began in 1991 involving the federal government, the states of California and Nevada, the Pyramid Lake Paiute Indian Tribe, and water purveyors from both states. The revised draft EIS/EIR for this agreement was distributed in 2004, and public comments are now being reviewed for preparation of the Final TROA EIS/EIR in 2006. When executed, the TROA would establish river operations procedures to meet water rights on the Truckee River and to enhance spawning flows in the lower Truckee River for cui-ui and Lahontan cutthroat trout. TROA would provide for management of water within the Truckee River Basin in California, including instream flow requirements and reservoir storage for fish and recreation uses, and would include procedures for operation and accounting of surface and groundwater diversions in California's part of the Truckee Basin.

Programs to manage Lake Tahoe water quality by regulating development and preventing pollutants from reaching the lake are being implemented at the federal, State, and local levels. The Tahoe Regional Planning Agency (TRPA), a bistate agency created by Congress, sets regional environmental standards, issues land use permits (including conditions to protect water quality), and takes enforcement actions throughout the basin. TRPA's regional plan provides for achievements and maintenance of environmental targets by managing growth and development. In addition to its regulatory activities, TRPA carries out a capital improvement program to repair environmental damage done before the regional plan was adopted.

Task Forces and Advisory Panels

California Commission on Building for the 21st Century. The commission was directed to "study the building and infrastructure needs of California, with the intent of identifying existing critical infrastructure needs and developing a comprehensive long-term capital investment plan for financing public building needs, including responsible financial approaches and efficiency improvements." In 2000 at the recommendation of this commission and with the support of the Governor and the Legislature, more than $4 billion in parks and water bonds were placed on the ballot (propositions 12 and 13) and approved, constituting the largest such State investment in the nation's history (California Commission on Building for the 21st Century 2001).

California Floodplain Management Task Force. This task force was established in early 2002 to examine specific issues related to State and local floodplain management. The diverse group of private, nonprofit, and local interest groups and State, federal, and local agencies created more than 30 recommendations for improved floodplain management. (See Volume 2 Resource Management Strategies, Chapter 10 Floodplain Management for summary of task force recommendations.)

Desalination Task Force. AB 2717 called for DWR to establish a Desalination Task Force. On Oct. 9, 2003, DWR submitted "Water Desalination—Findings and Recommendations" to the Legislature on potential opportunities for desalination of seawater and brackish water in California, impediments to using desalination technology, and what role, if any, the State should play in furthering the use of desalination. (See Volume 2 Resource Management Strategies, Chapter 6 Desalination for recommendation summary of task force.)

The Governor's Advisory Drought Planning Panel. This panel was formed in 2000 to develop a contingency plan to address the impacts of critical water shortages with the recognition that health, welfare, and economy of California are among those severely impacted. As part of a five-year planning program to implement specific actions of the CALFED Bay-Delta Program, the panel made recommendations for actions that State government could take (December 2000 report, "The Critical Water Shortages Contingency Plan"). The recommendations included a critical water shortage reduction marketing program to facilitate intraregional, short-term, and dry-year transfers, financial and planning assistance to local agencies for drought-related response activities, and assistance to small water systems and homeowners in rural counties. The work on these programs started early 2002 and is ongoing through bond measures Proposition 13 (March 2000) and Proposition 50 (November 2002). (See Volume 4 Reference Guide article "Selected Task Force and Advisory Panels" for this panel's recommendations.)

Landscape Task Force. Governor Arnold Schwarzenegger signed AB 2717 in September 2004. It asks the California Urban Water Conservation Council to set up a landscape task force to evaluate landscape water use efficiency and make recommendations for improvements. The task force, convened in February 2005, includes representatives from water suppliers and agencies, landscape contractors, the green industry, cities and counties, environmental groups, and state and federal agencies. The main charge of the task force is to recommend changes to the Model Water Efficient Landscape Ordinance and to look at other landscape issues to promote water conservation. The task force plans to submit a final report to the California Legislature and Governor by December 31, 2005. (See Volume 2, Chapter 22 Urban Water Use Efficiency for the task force's draft recommendations.)

State Recycling Task Force. Noting the importance of water recycling to our state, a 40-member California Recycled Water Task Force was established pursuant to AB 331(Goldberg, Chapter 590, Statutes of 2001).The task force was charged with evaluating the framework of State and local rules, regulations, ordinances, and permits to identify the opportunities, obstacles, or disincentives to maximizing the safe use of recycled water. (See Volume 2 Resource Management Strategies, Chapter 16 Recycled Municipal Water for recommendation summary of the task force's report (2003).)

State Watershed Management Guidelines and Initiative. AB 2117 (Stats. 2000, ch. 735) required a report to the Legislature on California's watershed status and any needed changes in State laws. The State Secretary for Resources and chair of SWRCB formed the Joint Task Force on California Watershed Management, an interagency and stakeholder effort, to discuss the results of the 10 case studies, to refine the findings, and to craft major recommendations to move the state in a new direction to protect and restore watersheds, lakes, rivers, and estuaries in California. The task force issued its recommendations in "Addressing the Need to Protect California's Watersheds: Working with Local Partnerships" (SWRCB 2002).

The Watershed Subcommittee of the Bay-Delta Public Advisory Committee. The Watershed Subcommittee meets monthly, usually in Sacramento, to review progress in watershed management and provide input and advice to the CBDA Watershed Program. Participants come from state and local government, nonprofit corporations, and the private sector. Highlights of watershed work in various watersheds throughout the state are provided as part of each meeting.

DWR Bulletins and Reports

California's Groundwater Update 2003 (Bulletin 118). DWR has long recognized the need for collection, summary, and evaluation of groundwater data as tools in planning optimal use of the groundwater resource. Bulletin 118 presents the results of groundwater basin evaluations in California.

Fish Passage Improvement Program. A part of the CALFED Ecosystem Restoration Program, the Fish Passage Improvement Program is a partnership-building effort to improve and enhance fish passage in Central Valley and San Francisco Bay Area rivers and streams. Local, State, and federal agencies and stakeholders cooperatively plan and implement projects that remove barriers impeding migration and spawning of anadromous fish. The inaugural issue of Bulletin 250 (DWR 2003) presented for the first time aggregated information on fish passage impediments and activities to address the decline in riverine habitat within the Fish Passage Improvement Program geographic scope.

Flood Warnings: Responding to California's Flood Crisis. This Flood Management White Paper (DWR 2005) presents an overview of the current condition of flood management in the Central Valley and outlines a plan to reduce flood risks through an integrated approach for better planning, new investments, improved management of our infrastructure and closer collaboration between water agencies and users.

Management of the California State Water Project. Bulletin 132 is a series of annual reports that began in 1963 and describe the status of SWP operations and water deliveries. The most recent issue is Bulletin 132-03, which covers the period from January 1, 2002, to December 31, 2002 (DWR 2004). The report updates information regarding project costs and financing, water supply planning, power operations, and significant events that affect the management of the SWP. Bulletin 132-03 also discusses water supply and delivery, the continuation of construction of the East Branch Extension, Delta resources and environmental issues, including the CALFED Bay-Delta Program; Oroville facilities relicensing; financial analysis of the SWP; and the update of business systems in DWR.

Water Bonds

Voters have approved three additional major California water bonds since the last water plan update:

- Proposition 13. $1.97 billion in bonds to support safe drinking, water quality, flood protection, and water reliability projects throughout the state. Approved by voters March 2000.
- Proposition 40 "California Clean Water, Clean Air, Safe Neighborhood Parks, and Coastal Protection Act of 2002." A $2.6 billion in bonds administered by 18 departments for various programs, including water quality, watershed protection and restoration, and protection of wildlife habitat. Approved by voters March 2002.
- Proposition 50 "Water Security, Clean Drinking Water, Coastal and Beach Protection Act of 2002." This $3.4 billion bond provides $825 million (Chapter 7 funding) for CALFED for a variety of programs. Also, DWR is to administer one-half of the $500 million (Chapter 8 funding) for Integrated Regional Water Management grants for projects to "protect com munities from drought, protect and improve water quality, and improve local water security by reducing dependence on imported water." Approved by voters November 2002.

AB 303 (Local Groundwater Management Assistance Act of 2000). The intent of AB 303 is to provide grant funding to help local agencies conduct groundwater studies or carry out groundwater monitoring and management activities, including the development of groundwater management plans. The maximum grant available is $250,000.

Federal Planning (Water 2025)

Water 2025: Preventing Crises and Conflict in the West calls for concentrating existing federal financial and technical resources in key western watersheds and in critical research and development such as water conservation and desalinization that will help to predict, prevent, and alleviate water supply conflicts. Water 2025 proposes modernizing aging water supply structures (from dams and reservoirs to pumping stations, pipelines, and canals) and improving regional water planning and tools to help stretch existing water supplies with improved conservation, more efficiencies, and better monitoring.

A primary principle of Water 2025 is that solutions to complex water supply issues must recognize and respect state, tribal, and federal water rights, contracts, and interstate compacts and decrees of the U.S. Supreme Court that allocate the right to use water. (See Box 3-11 Water 2025 (Federal) Principles, Realities, and Key Tools).

In support of watershed management, federal agencies are subject to the Unified Federal Policy for Watersheds. The UFP guides the actions of key federal agencies such as the departments of Agriculture, Commerce, Energy, and Interior as well as the U.S. Environmental Protection Agency and the U.S. Army Corps of Engineers. This policy emphasizes the following:

- Assessing the functions and condition of watersheds
- Incorporating watershed goals in federal agency planning and programs
- Enhancing pollution prevention
- Improving monitoring
- Restoring watersheds
- Identifying waters of exceptional value
- Expanding collaboration among federal agencies, States, tribes, and interested stakeholders.

Understanding How Water Is Allocated, Used, and Regulated

California has a very large and complex water system with a highly decentralized system of governance involving State and federal agencies, thousands of local agencies, governments and private firms, and millions of households and farms. Decentralization has a major influence on daily management, planning, and policymaking. Competing and conflicting roles and responsibilities make it difficult to integrate regional water management. Differing roles of the various State, federal, and local governments during planning can create coordination

problems. The organizational structure of State government can cause insufficient communication, coordination, and cooperation among numerous State agencies and departments responsible for water.

Institutional Framework

In California water use and supplies are controlled and managed under an intricate system of common law principles, constitutional provisions, State and federal statutes, court decisions, and contracts or agreements. All of these components constitute the institutional framework for the protection of public interests and their balance with private claims in California's water allocation and management. (See Box 3-12 Some Regulations Governing Water-related Resources Management and more details in Volume 4 Reference Guide articles "Water Allocation, Use and Regulation in California" and "Recent Water Legislation.")

Constitutional, Statutory, and Common Law Framework for Water Uses

Water rights in California are subject to State constitutional prohibition of wasteful or unreasonable use. California's water law and policy requires that "water resources of the State be put to beneficial use to the fullest extent of which they are capable" (Cal. Const., art. X, § 2). It places a significant limitation on water rights by prohibiting the waste, unreasonable use, unreasonable method of use, or unreasonable method of diversion of water. However, the interpretation of what is wasteful can vary significantly depending on the circumstances and may depend on opinions of the SWRCB or, ultimately, the courts.

Public Trust Doctrine

Rights to use water are also subject to the State's obligation under the Public Trust Doctrine as trustee of certain resources for Californians. The Public Trust Doctrine imposes legal responsibilities on State agencies to protect trust resources associated with California's waterways, such as navigation, fisheries, recreation, ecological preservation, and related beneficial uses. In *National Audubon Society v. Superior Court of Alpine County*, the California Supreme Court concluded that the public trust is an affirmation of the duty of State government to protect the people's common heritage of streams, lakes, marshlands, and tidelands, surrendering such protection only in rare cases when the abandonment of that right is consistent with the purposes of the trust. Thus, California agencies have fiduciary obligations to the public when they make decisions affecting trust assets.

In *National Audubon*, the court addressed the relationship between the Public Trust Doctrine and California's water rights system and integrated them. The court reached three major conclusions:

1) The State retains continuing supervisory control over its navigable waters, the lands beneath them, and the flows of their tributary streams. This prevents any party from acquiring a vested right to appropriate water in a manner harmful to the uses protected by the public trust. SWRCB may reconsider past water allocation decisions in light of current knowledge and current needs.
2) As a practical matter, it will be necessary for the State to grant usufructuary licenses to allow appropriation of water for uses outside the stream, even though this taking may unavoidably harm the trust uses of the source stream.
3) "The State has an affirmative duty to take the public trust into account in the planning and allocation of water resources, and to protect public trust uses whenever feasible."

Thus, while the State may, as a matter of practical necessity, have to approve appropriations that will cause harm to trust uses, it "must at all times bear in mind its duty as trustee to consider the effect of such taking on the public trust, (cite omitted) and to preserve, so far as consistent with the public interest, the uses protected by the trust."

Surface Water Rights

California's system for surface water rights recognizes both riparian rights and appropriative rights. Riparian rights were adopted in California as a part of the English common law when California became a state in 1850. At that time, gold miners were already operating under their own system that recognized claims to water rights based on prior appropriation.

- Riparian. A riparian right is the right to divert, but not store, a portion of the natural flow for use based on the ownership of property adjacent to a natural watercourse. Water claimed through a riparian right must be used on the riparian parcel. Such a right is generally attached to the riparian parcel of land except where a riparian right has been preserved for noncontiguous parcels when land is subdivided. Generally, riparian rights are not lost through non-use. All riparian water users have the same priority; senior and junior riparian water rights do not exist. During times of water shortage, all riparian water users must adjust their water use to allow equal sharing of the available water supply.
- Appropriative. Under the prior appropriation doctrine, a person may acquire a right to divert, store, and use

water regardless of whether the land on which it is used is adjacent to a stream or within its watershed. When water in a stream is over-appropriated, a priority system determines which appropriators may divert water. The rule of priority between appropriators is "first in time is first in right." A senior appropriative water rights holder may not change an established use of the water to the detriment of a junior, including a junior's reliance on a senior's return flow. Acquisition of appropriative water rights is subject to the issuance of a permit (followed by a license) by SWRCB with priority based on the date that the associated application for the appropriation of water was received by the SWRCB and was complete. Permit and license provisions do not apply to pre-1914 appropriative rights (those initiated before the Water Commission Act took effect in 1914), but pre-1914 rights are still subject to reasonable and beneficial use. Appropriative rights may be sold or transferred.

Groundwater Use and Management

California does not have a statewide permitting system or a statutory scheme to regulate groundwater extraction. However, case law has defined the nature of rights to groundwater, and there are several institutional mechanisms by which groundwater is managed on a local or basin-wide level. A landowner whose property overlies a groundwater basin has an "overlying" right to build a well and extract groundwater for reasonable and beneficial uses. That overlying right is correlative with the rights of all other overlying landowners in the basin.

In California, correlative rights are not defined unless the basin has been adjudicated. When a basin is adjudicated, the court identifies who can legally extract groundwater and the amount they can extract. There are 20 adjudicated groundwater basins in which the rights to groundwater have been determined by the court and groundwater is managed under court supervision.

In a basin that has not been adjudicated, if there is surplus groundwater after the reasonable and beneficial needs of the overlying landowners are met, the surplus groundwater can be appropriated for use on non-overlying land. This is called an appropriative right, and it has a lower priority than an overlying right. There is no codified procedure for determining either when

Box 3-11 Water 2025 (Federal) Principles, Realities, and Key Tools

Six principles to guide the federal Department of the Interior in addressing water problems:

- Recognize and respect state, tribal, and federal water rights, contracts, and interstate compacts or decrees of the U.S. Supreme Court that allocate the right to use water
- Maintain and modernize existing water facilities so they will continue to provide water and power
- Enhance water conservation, use efficiency, and resource monitoring to allow existing water supplies to be used more effectively
- Use collaborative approaches and market based transfers to minimize conflicts
- Improve water treatment technology, such as desalination, to help increase water supply
- Existing water supply infrastructure can provide additional benefits for existing and emerging needs for water

Five realities that drive water crises:

- Explosive population growth is taking place in areas of the West where water is already scarce
- Water shortages occur frequently in the West
- Over-allocated watersheds can cause crisis and conflict
- Water facilities are aging
- Crisis management is not effective in dealing with water conflicts

Four key tools to help manage scarce water resources:

- Conservation, efficiency, and markets
- Collaboration
- Improved technology
- Removal of institutional barriers and increased interagency cooperation

http://www.doi.gov/water2025/

Box 3-12 Some Regulations Governing Water-related Resources Management

Regulations protecting water quality. Water quality is an important aspect of water resource management.

- Clean Water Act-National Pollutant Discharge Elimination System
- Porter-Cologne Water Quality Control Act
- Safe Drinking Water Act
- California Safe Drinking Water Act

Environmental laws and regulations. Several laws outline the state and federal obligations to protect and restore degraded habitats and species.

- Federal Endangered Species Act
- California Endangered Species Act
- Natural Community Conservation Planning
- Clean Water Act and River and Harbors Act (Dredge and Fill Permits)
- Water Code (Public Interest Terms and Conditions, etc.)
- Fish and Game Code (Streambed Alteration Agreements, Releases of Water for Fish, etc.)
- Migratory Bird Treaty Act
- Fish and Wildlife Coordination Act
- Central Valley Project Improvement Act
- State and Federal Wild and Scenic Rivers System
- National Wilderness Act
- Unified Federal Policy for Watersheds

Regulating project planning, implementation and mitigation. Another set of environmental statutes compels governmental agencies and private individuals to document and consider the environmental consequences of their actions.

- National Environmental Policy Act
- California Environmental Quality Act

Regulations for water use efficiency. Water Code section 275 directs the Department and SWRCB to "take all appropriate proceedings or actions before executive, legislative, or judicial agencies to prevent waste or unreasonable use of water."

- Urban Water Management Planning Act
- Water Conservation in Landscaping Act
- Agricultural Water Management Planning Act
- Agricultural Water Suppliers Efficient Management Practices Act
- Agricultural Water Conservation and Management Act (AB3616) of 1992
- Water Recycling Act of 1991
- CALFED Water Use Efficiency Program

Local land use. Water planning is influenced by local land use requirements.

- Local General Plans and Specific Plans
- SB 221
- SB 610

Other regulations. Some other regulations that influence water resource management include:

- Cloud Seeding Regulations
- Federal Power Act
- State Water Resources Control Board decisions

there is a surplus of groundwater, or how much groundwater is surplus. An appropriator can use the groundwater outside the basin, or the appropriator may be a municipal water purveyor that serves water to users in the same basin. In groundwater basins that have been overdrafted, a public agency may establish a prescriptive right by openly and publicly pumping water in excess of the available supply for five years.

In many basins, groundwater is managed by a local agency. Over 200 local agencies have prepared and adopted groundwater management plans in accordance with AB 3030, (1992; Water Code § 10750, et seq.). Thirteen other agencies have been granted specific authority to manage groundwater through special acts of the Legislature. Twenty-seven counties have adopted a groundwater ordinance, many of which require a permit before any groundwater can be exported. To obtain a permit, most ordinances require a project proponent to show that the project will not deplete the groundwater supply, degrade groundwater quality, or cause land subsidence. While an appellate court has affirmed a county's police power to regulate groundwater extraction and export, the full scope of a county's power to manage groundwater is not clear.

Tribal Water Rights

Some Indian reservations and other federal lands have reserved water rights implied from acts of the federal government, rather than State law. When tribal lands were reserved, their natural resources were implicitly reserved for tribal use. Because reserved tribal rights were generally not created by state law, states' water allocations did not account for tribal resources. In the landmark Winters v. U.S. case in 1908, the U.S. Supreme court established that sufficient water was reserved to fulfill the uses of a reservation at the time the reservation was established. The decision, however, did not indicate a method for quantifying tribal water rights. Winters rights also retain their validity and seniority over State appropriated water whether or not the tribes have put the water to beneficial use. Only after many years did tribes begin to assert and develop their reserved water rights. In 1963 the U.S. Supreme Court decision Arizona v. California reaffirmed Winters and established a quantification standard based on irrigation, presupposing that tribes would pursue agriculture. Despite criticisms of the "practicably irrigable acreage" (PIA) quantification standard from various perspectives, the PIA standard provided certainty to future water development. Quantifying water needs in terms of agricultural potential does not accurately show the many other needs for water. Even urban water quantity and quality assessments that look at the adequacy of the domestic water supply and sanitation do not provide a complete picture of tribal water needs. A large part of the tribal water needs are for instream flows and other water bodies that support environmental and cultural needs for fishing, hunting, and trapping.

The 1902 Reclamation Act provided for the establishment of irrigated agriculture and settlement throughout the Western states. Historical perspective indicates this policy was pursued generally without regard to Indian water rights or the 1908 Winters decision. In 1952 Congress passed the McCarran Amendment which waived sovereign immunity and authorized the adjudication of federal water rights in stream adjudications brought in state courts. The court later ruled that state adjudications may also apply to Indian reserved water rights held in trust by the United States. In asserting their Winters rights, tribes have come into conflict with water-using development that grew out of substantial federal and private investment. Costly litigation, negotiation, or both are the usual means of resolving Indian water disputes, and some cases can take decades to reach agreement. Some tribes request assistance from the federal government to pursue their water rights settlements, reminding concerned parties of the conflicting roles the federal government can assume on two or more sides of a judicial or administrative issue.

Law of the River

The Colorado River is managed and operated under numerous compacts, federal laws, court decisions and decrees, contracts, and regulatory guidelines collectively known as the "Law of the River." In 1922 the seven Colorado River Basin states negotiated the Colorado River Compact, which divided the states into two basins—upper and lower—and apportioned 7.5 million acre-feet per year to each basin. The compact also referenced Mexico's right to the Colorado River. The Boulder Canyon Project Act of 1928 ratified the compact and established California's apportionment at 4.4 million acre-feet per year[3]. In 1944 the United States signed a water treaty in which it agreed to deliver a quantity of 1.5 million acre-feet of water annually to Mexico.

While compact negotiators estimated the flow of the river to be at least 17 million acre-feet per year, today's records indicate a flow of 15 million acre-feet at Lee Ferry just below Lake Powell. Consequently, the sum of the actual compact apportionments and the Mexican treaty exceed the flow of the river in most years.

[3] See Colorado River Agreement under Programs and Planning section for discussion of 2003 QSA.

Water Contracts

Water contracts are a way for an entity to obtain short-term or long-term access to water without having specific water rights. State, federal, and many local water agencies have written contracts for delivery of water to other water purveyors or customers. Both the SWP and CVP have water rights that are subject to area of origin protections (see following section). The Operating Criteria and Plan provides detailed analysis of proposed CVP and SWP operations (see www.usbr.gov/mp/cvo/ocap.html). Both projects have written contracts to deliver water to water agencies that repay capital and operating costs. During some years, water deliveries are lower than the contract amounts shown below. (For actual deliveries in 1998, 2000, and 2001, see the water portfolios for each region in Volume 3 Regional Reports).

- State Water Project—DWR has long-term water supply contracts for water service from the SWP with 29 local agencies for about 4.2 million acre-feet annually. The majority of the SWP goes to urban uses. These long-term contracts were updated in the Monterey Amendments, and their provisions were revised in 2003 as part of a settlement agreement with the Planning and Conservation League (see "Joint Statement on the Monterey Amendments Litigation" in the Volume 4 Reference Guide).
- Central Valley Project—The CVP supplies water to more than 250 long-term water contractors extending from Shasta County in the north to Kern County in the south. Collectively, the contracts call for a maximum annual delivery of 9.3 million acre-feet: 4.8 million acre-feet is classified as project water, and 4.5 million acre-feet is classified as water right settlement water. In October 2004, the Bureau of Reclamation released the draft environmental impact statement (EIS) for the proposed long-term renewal of contracts between Reclamation and up to 145 Sacramento River Settlement Contractors. Starting in February 2005, USBR began signing long-term contracts for 25 or 40 years, depending on contract type. The contracts will provide water for 3.4 million acres of farmland in the Sacramento and San Joaquin Valleys that produce billions of dollars in gross farm revenue and provide municipal and industrial water for more than 3 million people and businesses, including Silicon Valley. Delivering this water also generates enough electricity for 2 million households.

Area of Origin Protections

During the years when California's two largest water projects, the CVP and SWP, were being planned and developed, area of origin provisions were added to the Water Code to protect local Northern California supplies. County of origin statutes reserve water supplies for counties in which the water originates. The Delta Protection Act, enacted in 1959 (not to be confused with the Delta Protection Act of 1992), requires the SWP and the CVP to provide salinity control in the Delta and an adequate water supply for water users in the Delta. In 1984 additional area of origin protections were enacted to prohibit the export of groundwater from the combined Sacramento River and Delta basins, unless the export is in compliance with local groundwater plans.

Water for Environmental Uses

Several laws outline the state and federal obligations to protect and restore degraded habitats and species:

- Federal Endangered Species Act
- California Endangered Species Act
- Natural Community Conservation Planning Act
- Clean Water Act and River and Harbors Act (Dredge and Fill Permits)
- Water Code (Public Interest Terms and Conditions, etc.)
- Fish and Game Code (Streambed Alteration Agreements, Releases of Water for Fish, etc.)
- Migratory Bird Treaty Act
- Fish and Wildlife Coordination Act
- Central Valley Project Improvement Act
- State and Federal Wild and Scenic Rivers System
- National Wilderness Act.
- Unified Federal Policy for Watersheds

For more information on these and other laws and regulations, see Volume 4 article "Water Allocation, Use, and Regulation in California."

Water Transfers

Every year hundreds of water transfers (totaling hundreds of thousands of acre-feet) take place between water users for a wide variety of reasons. Some provide water on a short-term basis for drought-year emergency water supplies and some provide for long-term water supplies. Water transfers occur within districts and projects and between regions. The State has helped transfers by purchasing and selling water through the Drought Water Bank and, more recently, the Dry Year Water Transfer Program. Short-term water transfers also include SWP supplemental water purchases and Central Valley Project Improvement Act and Environmental Water Account water acquisitions. (See Volume 2 Resource Management Strategies, Chapter 23 Water Transfers for more detail.)

Institutional Roles

The State and federal governments are responsible for representing and protecting the public trust (certain types of property of high public value held for the benefit of all citizens). Together, the State and federal governments provide assistance, guidance, and oversight to local governments (city- and county-owned municipal water systems, etc.), American Indian tribes, and special districts.

California Government

Many State departments and agencies oversee California's water resources. DWR operates the SWP and is responsible for overall water planning. SWRCB integrates water rights and water quality decision-making authority. SWRCB and the nine Regional Water Quality Control Boards are responsible for protecting California's water resources. Pursuant to the Porter-Cologne Water Quality Control Act, water quality control plans for each of the nine regions become part of the California Water Plan. Other State agencies and their roles in water management follow:

- California Bay-Delta Authority—Oversees the 23 State and federal agencies working cooperatively through the CALFED Bay-Delta Program to improve the quality and reliability of California's water supplies while restoring the Bay-Delta ecosystem.
- California Coastal Commission—Plans for and reg-ulates land and water uses in the coastal zone consistent with the policies of the Coastal Act.
- California Department of Conservation—Provides services and information that promote environmental health, economic vitality, informed land-use decisions, and sound management of California's natural resources.
- California Environmental Protection Agency—Restores, protects, and enhances the environment to ensure public health, environmental quality, and economic vitality.
- California Integrated Waste Management Board—Manages the estimated 76 million tons of waste generated each year by reducing waste whenever possible, promoting the management of all materials to their highest and best use, and protecting public health and safety and the environment.
- California Public Utilities Commission—Regulates privately owned water and other utility companies.
- Colorado River Board—Protects California's rights and interests in the resources provided by the Colorado River.
- Delta Protection Commission—Responsible for preparation of a regional plan for the "heart" of the Delta.
- Department of Fish and Game—Regulates and conserves the state's wildlife and is a trusteefor fish and wildlife resources (FDC § 1802).
- Department of Food and Agriculture—Supports California's agricultural economy.
- Department of Health Services—Oversees programs to protect and improve the health of all Californians, regulates and permits drinking water.
- Department of Pesticide Regulation—Regulates pes-ticide sales and use and plays a significant role in monitoring for the presence of pesticides and in preventing further contamination of the water resource.
- Department of Toxic Substances Control—Provides technical oversight for the characterization and remediation of soil and water contamination.
- Reclamation Board—Plans flood controls along the Sacramento and San Joaquin rivers and their tributaries in cooperation with the U.S. Army Corps of Engineers.

Federal Government

USBR operates the CVP, the largest water project in California, and regulates diversions from the Colorado River. Other federal agencies play important roles in the regulation and management of California's water resources:

- Army Corps of Engineers—Plans, designs, builds, and operates water resources projects (navigation, flood control, environmental protection, disaster response, etc.).
- Federal Energy Regulatory Commission (FERC)—Regulates the interstate transmission of electricity, natural gas, and oil. FERC also reviews proposals to license hydropower projects.
- National Marine Fisheries Service (NOAA Fisheries)—Protects and preserves living marine resources, including anadromous fish.
- National Park Service—Manages national parks, including their watersheds.
- U.S. Bureau of Land Management- Manages federal lands.
- U.S. Bureau of Reclamation—Constructs federal water supply projects and is the nation's largest wholesaler of water and the second largest producer of hydroelectric power.
- U.S. Department of Agriculture (USDA)—Manages forests, watersheds, and other natural resources.
- [USDA] Natural Resource Conservation Service- Provides technical and financial assistance to conserve, maintain, and improve natural resources on private lands.
- U.S. Environmental Protection Agency—Protects human health, safeguarding the natural environment.
- U.S. Fish and Wildlife Service—Conserves, protects, and enhances fish, wildlife, and plants and their habitats.
- U.S. Geological Survey—Provides water measurement and water quality research.

- Western Area Power Administration—Manages power generated by the Central Valley Project.

American Indian Tribes

American Indian tribes exist under a unique relationship with the federal government—as beneficiary and trustee, respectively. In a broad sense, the federal government has a fiduciary responsibility to tribes; however, the execution and effectiveness of this responsibility differ between the three branches of the federal government.

When reservation lands were set aside, the natural resources of the reservations also were reserved for tribal people. The federal government is legal titleholder to all trust resources. American Indian tribes operate in this government-to-government relationship and help plan water resource projects affecting tribal land. Several landmark decisions have defined legal principles for intergovernmental relationships and tribal rights. In California and elsewhere, tribes without federal recognition do not enjoy governmental status or benefits. Tribal water rights are discussed under the section Institutional Framework.

Reversing a long trend of administrative and economic failures in the administration of the government's trust relationship with tribes, President Richard Nixon in 1970 issued a statement in support of strengthening tribal governments and improving the trust relationship. The federal government has initiated programs to encourage development of Indian resources and tribal self-determination. The socioeconomic and political history of California Indians is documented in many published reports. Some are cited in the list of references for this water plan. At the request of the California State Senate, in 2003 the California Research Bureau published an online report, "Early California Laws and Policies Related to California Indians" (CRB-02-014).

Public Agencies, Districts, and Local Governments

Local city and county governments and special districts have ultimate responsibility for providing safe and reliable water to their customers. In general, California has two methods for forming special districts that develop, control, or distribute water: (1) enactment of a general act under which the districts may be formed as set forth in the act, and (2) enactment of a special act creating the district and prescribing its powers. (See Volume 4 Reference Guide for article "What's So Special about Special Districts? A Citizen's Guide to Special Districts in California.")

Cities and counties are the land management and planning entities as well as resource management agencies that most influence the location and amount of population growth within the state. Many counties have adopted ordinances that require permits for certain uses of groundwater within their boundaries.

Private Entities

In addition to public agencies, private entities may provide water supply. Mutual water companies, for example, are private corporations that perform water supply and distribution functions similar to public water districts. Investor-owned utilities are also involved in water supply activities, sometimes as an adjunct of hydroelectric power development. These investor-owned water companies are regulated by the California Public Utilities Commission.

International Trade Agreements

Since January 2000 more than 140 World Trade Organization (WTO) member governments have been negotiating to further liberalize the global services market. The General Agreement on Trade in Services (GATS) is among WTO's most important agreements. It is a set of multilateral rules covering international trade in services. GATS recognizes "the right of Members to regulate, and to introduce new regulations, on the supply of services ... in order to meet national policy objectives." No international trade treaty now in effect or being negotiated by the United States prevents local, state, or federal government agencies from reviewing and regulating water projects that involve private companies with multinational ties. Such projects include desalination plants, water transfers, water storage projects (above and below ground), and wastewater reclamation projects. There is no conflict with international trade treaties as long as government regulations are applied to water projects involving multinational corporations in the same manner they are applied to water projects owned or operated by domestic companies or public utilities.

Individual Water Users

Collectively, the millions of urban businesses, individual households, and farms fund the operation and maintenance of California's water systems through payment of taxes and water bills. Each makes decisions on water use and conservation for its own circumstances. Individual water users must dispose of used water, usually through a sewer or gutter, which in turn can create water pollution. This return flow can provide water to downstream water users. During drought periods, many households modify outdoor watering to conserve water. Each year, farmers make decisions on planting and water application based on weather conditions, forecasted water supply, and individual

tolerance for market risk. Taken together, these individual decisions about water use have an enormous impact on both water demand and water quality and present many opportunities for individuals to play positive roles in better managing California's water quantity and quality.

Institutional Tools for Managing Resources

In many cases, several institutional tools interact in managing resources:

- Collaborative decision-making—A decision made through collaboration can avoid the need for new legislation, regulation, and litigation.
- Education—Educational programs can be the least expensive way to influence public action. Information on water use efficiency practices, water costs, habitat conditions, and other important subjects can help the public become active participants in plan implementation.
- Legislation—Legislation can provide new statutes for managing resources. (See Volume 4 Reference Guide article "Recent Water Legislation.")
- Voter-approved propositions—Voters can directly enact new laws by approving propositions. In many cases, voters decide on major funding requests. Since 1996, voters have approved four major California water bonds (propositions 204, 13, 40, and 50).
- Regulation—State regulatory agencies adopt regulations (rules) to implement, interpret, or make specific the law enforced or administered by it, or to govern its procedure.
- Litigation—Lawsuits provide a dispute-resolution tool that most, if not all, water stakeholders will employ when it appears to be their best alternative. These judicial proceedings can provide greater certainty to water rights holders and to public trust values in California in ways that the collaborative process may fail to accomplish. Legal precedents create a framework for setting up water resource management programs, but do not themselves create or implement the programs. (See Volume 4 Reference Guide article "Summary of Significant Litigation 1998-2005.")